COMMITTEE ON PAPERS AND PUBLICATIONS

This committee has authority in all matters affecting the acceptance, rejection, editing and publication of papers, committee reports, and discussions. The committee also acts in an advisory capacity to the Executive Committee in publication matters in general.

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JANUARY—1940

No. 102

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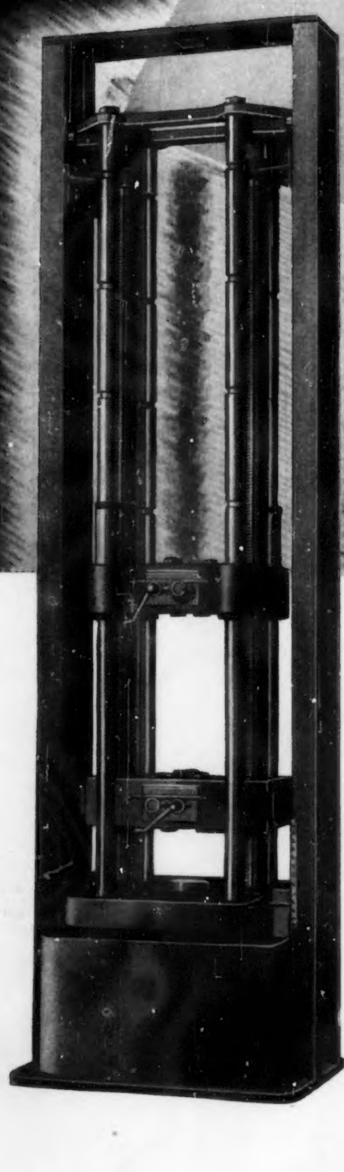

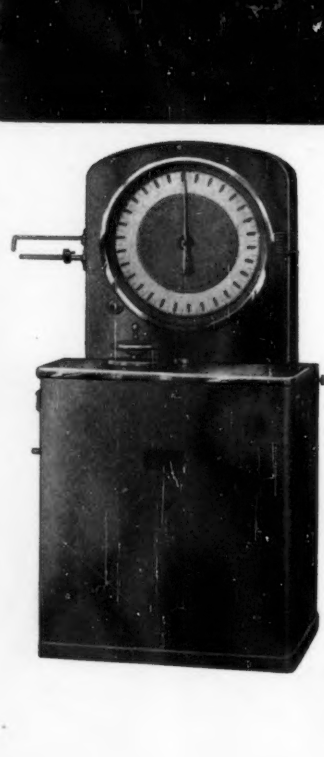

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Number 102 January, 1940

Two Sessions at Spring Meeting in Detroit

Symposium on New Materials in Transportation; Committee Week, March 4–8

In order that there will be ample time for presentation and discussion of the technical papers comprising the Symposium on New Materials in Transportation, the technical feature of the A.S.T.M. Spring Meeting to be held in Detroit on Wednesday, March 6, two sessions have been arranged, one to be held in the morning, the second following in the afternoon. The evening part of the meeting will comprise a dinner with a program appropriate for the Detroit area and the interests of the members and their guests who will be present.

The Spring Meeting is being held during A.S.T.M. Committee Week, March 4 to 8, inclusive, at the Hotel Statler.

General arrangements for the meeting are in the charge of the Detroit District Committee, headed by T. A. Boyd, Head, Fuel Dept., General Motors Research Laboratories, with subgroups responsible for specific assignments. The personnel of the committees is as follows:

Program Committee

C. E. Heussner, *Chairman*, Materials Engineer, Chrysler Corp.
W. H. Graves, Chief Metallurgist, Packard Motor Car Co.
J. W. Kennedy, Engineer, Service Bureau, Huron Portland Cement Co.
J. L. McCloud, Metallurgical Chemist, Ford Motor Co.
Peter Altman, Director, Department of Aeronautics, University of Detroit.
S. D. Heron, Research Engineer, Ethyl Gasoline Corp.

Banquet Committee

C. H. Fellows, *Chairman*, Head, Chemical Division, Research Dept., The Detroit Edison Co.
W. P. Putnam, President, Treasurer and Technical Director, The Detroit Testing Laboratory.
A. E. White, Director of Department of Engineering Research, and Professor of Metallurgical Engineering, University of Michigan.

Finance-Publicity Committee

W. C. Du Comb, *Chairman*, President, The W. C. Du Comb Co., Inc.
Sydney Bevin, Chief Engineer, Fiske Brothers Refining Co., Toledo, Ohio.
Martin Castricum, Manager, Textile Section, Product Development Division, United States Rubber Co.
J. L. McCloud, Metallurgical Chemist, Ford Motor Co.
H. C. Mougey, Technical Director, Research Laboratories, General Motors Corp.
J. H. Walker, Engineer Assistant to General Manager, The Detroit Edison Co.

Plant Inspection Committee

F. P. Zimmerli, *Chairman*, Chief Engineer, Barnes-Gibson-Raymond, Division of Associated Spring Corp.
V. M. Darsey, Technical Director, Parker Rust-Proof Co.
A. J. Herzig, Chief Metallurgist, Climax Molybdenum Co. of Michigan, Inc.
E. W. Upham, Chief Metallurgist, Chrysler Corp.

TECHNICAL PROGRAM

The symposium on New Materials in Transportation has been arranged by Mr. Heussner's committee with six papers covering important phases of the major topic, each prepared by outstanding authorities in the particular fields. The program follows:

Morning Session

Trends in the Properties of Volatile Liquid Fuels—D. P. Barnard and A. H. Fox, Research Dept., Standard Oil Co. (Indiana).
Developments in Lubrication—J. P. Stewart, R. C. Moran, and O. M. Reiff, Socony-Vacuum Oil Co.
Exhaust Valve Materials for Internal Combustion Engines—S. D. Heron, Ethyl Gasoline Corp.; O. E. Harder and M. R. Nestor, Battelle Memorial Institute.

Afternoon Session

Developments in Alloy Steel—E. W. Upham, Chrysler Corp.; W. H. Graves, Packard Motor Car Co.; A. L. Boegehold, General Motors Corp.; and F. E. McCleary, Chrysler Corp.
Rubber of Tomorrow—S. M. Cadwell, U. S. Rubber Co.
Advances in the Uses of Concrete in Transportation—Miles D. Catton, Portland Cement Assn.

Brief synopses of five of the papers which will comprise the symposium appear at the end of this article and will give some idea of the major problems to be covered. A number of authorities will be invited to present their viewpoints on various aspects of this field of materials in transportation.

DINNER

Complete details of the dinner program have not been settled, but the committee headed by Mr. Fellows is at work and an interesting session will result. A communication will be sent to members of the standing committees meeting in Detroit during Committee Week and all members in the Detroit and surrounding areas will receive full details of this feature of the meeting.

TRIPS

Mr. Zimmerli's committee is considering the trips that may be available to members, but final plans are contingent on the international situation. However, the committee undoubtedly can arrange special individual visits to various plants and it is suggested that members of the Society who are very anxious to visit a particular plant or establishment get in touch with Mr. Zimmerli in advance. The committee will cooperate closely in connection with these desires. Mr. Zimmerli should be addressed at Barnes-Gibson-Raymond, Division of Associated Spring Corp., 6400 Miller Ave., Detroit, Mich.

1940 COMMITTEE WEEK

From Monday through Friday, March 4 to 8, meetings of a large number of A.S.T.M. committees, their subcommittees, and sections will be in progress. Although committee work involving the 1939 Book of Standards was completed last year, practically all of the committees have a good deal of new work under way and in many cases revisions of existing standards are essential. Although a number of the committees are meeting in Washington and other points about the time of the 1940 Committee Week, it is expected upward of 100 meetings at least will be held. The groups which have signified their intention of participating in Detroit are as follows:

- Subcommittees of Committee A-1 on Steel
- A-3 on Cast Iron
- A-5 on Corrosion of Iron and Steel
- A-7 on Malleable Iron Castings
- B-3 on Corrosion of Non-Ferrous Metals
- C-8 on Refractories
- C-16 on Thermal Insulating Materials
- D-4 on Road and Paving Materials
- D-5 on Coal and Coke
- D-11 on Rubber Products
- D-18 on Soils for Engineering Purposes
- Technical Committees and Sections of Committee E-1 on Methods of Testing
- Research Committee on Fatigue of Metals

This is only a partial list and it is quite probable that other groups will take part. While the final schedule of meetings and room assignments will be available at the A.S.T.M. registration desk at the Hotel Statler, an advance schedule will be mailed to the members of all committees meeting, early in February. This material will also carry further announcement of the Spring Meeting and other information.

Synopses of Symposium Papers

Trends in the Properties of Volatile Liquid Fuels

by D. P. Barnard and A. H. Fox

This paper discusses the trends in the significant properties of four principal types of volatile liquid petroleum fuels, namely, Motor and Aviation Gasolines, Domestic Furnace Oils, and High Speed Diesel Fuels. Each of these fuels has, in turn, undergone various changes in certain aspects during its commercial use. Particular reference is made to approximate dates at which important properties of each fuel type become of sufficient interest to require recognition in the manufacture of the product and the development of standardized tests for use in quality control. These milestones have been traced throughout the principal history periods of the four fuel classes for the purpose of developing the best possible predicting of future trends in the more important properties.

The presentation will be made principally by means of charts.

Developments in Lubrication

by J. P. Stewart, R. C. Moran, and O. M. Reiff

The introduction to this paper covers the development of special chassis and gear lubricants during the past few years. It proceeds with the development of crankcase lubricants, showing the physical characteristics of oils produced from various crude oils using modern methods of refining. Finally, it covers the development of additives for crankcase lubricants and describes the characteristics provided by certain of the additives. Data are presented showing the physical characteristics of the finished oils and their performance under a number of laboratory test conditions in addition to certain field service tests.

The facts presented in this paper lead to the logical conclusion that the best lubricants are prepared by using the most modern refining methods to produce quality oils in which addition agents are incorporated to provide certain specific qualities demanded of present-day lubricants.

Exhaust Valve Materials for Internal Combustion Engines

by S. D. Heron, O. E. Harder, and M. R. Nestor

After reviewing briefly the history of past and present exhaust valve materials, the physical and chemical properties desirable in valve materials are discussed as well as the media which cause attack or corrosion. The probable influence of each of a number of physical properties on exhaust valve behavior is discussed at some length. Effects of operating temperature on a variety of types of material are reviewed.

Laboratory and engine test methods for exhaust valve materials are discussed and it is pointed out that no combination of laboratory tests will adequately predict the behavior of any given material in engine service. When a new valve material is evolved a very lengthy research, development, and testing program is required if the relative value of new material in terms of existing materials is to be definitely known. A specific case of such evolution and the test program involved is briefly discussed.

Developments in Alloy Steel

by E. W. Upham, W. H. Graves, A. L. Boegehold, and F. E. McCleary

Rubber of Tomorrow

by S. M. Cadwell

New materials used in today's transportation passed yesterday's tests better than the old materials they replaced. Tomorrow's new materials, in-

cluding rubber and its associated products, will pass today's tests better than today's materials. In the transportation industry, testing is the supreme umpire and judge.

Test data on new forms or types of rubber products will be reviewed with the expectation that as new or novel properties are found they will be utilized.

New facts have recently been discovered regarding the behavior of rubber in dynamic fatigue. They indicate that we will have to revise some of our concepts on how rubber should be loaded to obtain maximum fatigue resistance.

New synthetic materials are becoming of increasing importance in replacing rubber in specialized applications where tests show them to be definitely superior. The "rubber" of tomorrow will include a growing proportion of synthetic polymers in which the chemical architect will design the final molecule to meet specific needs.

New forms of older materials are coming into use. Foam sponge rubber made from latex is of growing importance. In addition, there is now a new type of soft cellular rubber in which the individual pores are not connected which is available for commercial applications. A similar structure in hard rubber has unique properties.

Improved knowledge of the adhering of rubber to metal is increasing the incorporation of rubber in metal structures.

The pneumatic tire is still, by far, the major use of rubber in transportation. Judged by recent progress we can look to the rubber of tomorrow to contribute further advances in this field. Rayon and rubber have already demonstrated their superiority in severe service.

Tests and demonstrations of special properties and materials will be given.

Advances in the Uses of Concrete in Transportation

by Miles D. Catton

History shows that the tempo of new developments in the United States is always quickened and sharpened in times of economic stress. History is again repeating itself in concrete as well as other fields where man's ingenuity finds opportunity for full play.

In the transportation field we find concrete becoming more and more a part of the development of transportation itself. In highways we find refinements in design which permit more accurate designing of concrete pavements which have developed side by side with the marvels of improvements in the automobile. The bridges needed for highways are likewise being refined in design, use, and beauty, with the "rigid frame" structure standing out in recent years. And under the concrete road we find engineers using cement to change weak supporting soils to strong supporting soils.

In the railroad field with the coming of Diesel engines and streamline trains comes the need of better roadbeds. To meet this need the railroads are beginning to give attention to possibilities of concrete for track support. Under present economic conditions these first installations are being made only at locations where track support is a major problem. However, the possible influence on railroad transportation comfort and speed may produce results that only our imagination can picture today.

In airports we find engineers turning to concrete to supply them with runways to carry their heavy planes, now being thought of in terms of 50 tons or more for war purposes. To meet these needs, the design requirements are being rapidly developed. Also as a part of the airport development is the construction of buildings which call into play the engineer who is learning to build thin "barrel" roofs of concrete to span large areas. He is also learning to construct his buildings for beauty as well as utmost utility with architectural concrete, "the stone you can mold," to meet the yearn of man to express his character in his labors.

Transcending all these advances in the uses of concrete which fire the imagination and ambition of an ever increasing number of men is one that is revolutionary and very new. It is not concrete we think of and know about today, but a new building material which utilizes only cement and the soil at hand. For lack of a better word today, we call the product "soil-cement." It is low in cost but has properties of strength, durability, and impermeability distinctly its own which are being rapidly developed. So far it has only been used by the highway engineer to build low-cost, light-traffic roads. However, its full field of use has yet to be developed. Airport engineers want it for their runways at secondary airports or to cover entire areas between concrete runways at primary airports. Other engineers are beginning to investigate its possible use any place a dustless, mudproof surface is desired. Some are beginning to investigate its use to stop washing on exposed earth slopes, to stop water seeping away from irrigation canals, drainage ditches, and storage reservoirs. Others see where the man living on our treeless plains may build a home of beauty and comfort from the soil of his dooryard as easily and economically as his brother living in forest areas or near concrete materials.

Ambassador Bridge

Rather extensive use was made of A.S.T.M. standards in connection with specification requirements and testing of materials used in the bridge. The structural carbon and silicon steel, steel castings, eyebars, and reinforcing steel were covered by A.S.T.M. specifications. The cement used in the masonry and pavements and the testing of the concrete and of the aggregates and paving block were in accordance with Society standards. In this connection it is of interest to note that some 2400 tons of structural steel and cable wire went into the bridge, 40,000 barrels of cement, and some 60,000 square yards of roadway pavement and 25,000 cubic yards of concrete masonry.

Records Broken in 1939—Much Active Work Under Way

Committee Officers Outline Many Active Research and Standardization Projects in Process; Several New and Important Accomplishments During 1939

Bhartrihari, a Hindu poet, writing in the Fifth Century is supposed to have said:

> All we in one long caravan
> Are journeying since the world began;
> We know not whither, but we know
> Time guideth at the front, and all must go.

A year (like a mile) is a measured distance along the roadway of Time, and when we come to the end of a year, we are not necessarily approaching an intersection or any change in direction, but in most cases are keeping straight on. Since the wake of a vessel reveals more clearly to those on board the general direction in which the boat is traveling than does the pointing of the bow, it is well in casting a glance ahead to look back at the wake and on this basis consider future procedures.

In connection with A.S.T.M. it has been customary in the January Bulletin to record some of the outstanding events and accomplishments of the past year as a background for that portion of the article which outlines some of the very active work in progress, including many new standardization and research projects. Very definitely, the article is designed as more of a preview than a review, thus eliminating some of the deadening effects that a review article may inadvertently incorporate.

Much of the material which follows, especially under the various materials divisions, is based on statements furnished each year by officers of the standing committees. The committee material is segregated in accordance with the sequence of committee designations. The "A" group (ferrous metals) appears first followed by the "B" group (non-ferrous metals and alloys) and then the "C" committees (cementitious, ceramic, concrete, and masonry), and finally the "D" committees covering a wide range of materials.

Many Records Broken

From the standpoint of standardization accomplishments 1939 broke all existing records. This might be expected because of the great growth in the Society's work during the past three years since the last Book of Standards in 1936, but one might expect a diminution in the number of new specifications and tests reported. The fact that during the year 89 new tentative standards were approved (this includes the June Annual Meeting actions and the August Committee E-10 actions) bespeaks the intensity of new work. The figures on the number of existing tentative specifications adopted as standard—107—and revisions of standards adopted—some 118—exceed by about 50 per cent the figures for the last comparable year, namely, 1936.

The number of pages in regular publications that will have been issued in 1939 publications is the largest the Society has ever issued, comprising some 6292 compared with the previous high in 1936 of 5329.

While not a "record-breaker," possibly the most noteworthy development during the year has been in publishing the Book of Standards.

1939 Book of Standards—Three Parts; Book of Tentative Standards Discontinued; Proceedings in One Volume

Accelerated growth of work in the standardization field resulting in many more standards and tentative standards presented publication problems, which culminated in a decision to incorporate all tentative specifications as well as standard specifications in the 1939 Book of Standards and instead of publishing this in two parts as has been done since 1924, to issue three parts, made up of Part I.—Metals; Part II.—Nonmetallic Materials—Constructional; and Part III.—Nonmetallic Materials—General. With this change involving the discontinuance of the annual Book of Tentative Standards, the *Proceedings*, formerly in two parts, were combined and the 1939 *Proceedings*, to be put in the mails sometime in February, will include both technical papers and committee reports. The policy of publishing new tentative standards in the *Proceedings* each year has been discontinued because they are now in the Books of Standards and each year the Supplements will keep this publication up to date.

The Book of Standards is the Society's most important publication and one of industry's most widely used books; hence this important change in its method of issuance certainly will mark 1939 as an outstanding year. Change in the format of the book enabled detailed editorial study to be made of practically all of the specifications, which were reset in double-column format with accompanying improvements and changes.

Meetings: Annual, Spring, and District

The Forty-second Annual Meeting held in Atlantic City resulted in another record, namely, the highest registration of any of the meetings held thus far save the 1937 meeting in New York City, the respective figures being 1354 and 1523, the latter including a considerably larger number of visitors than an average meeting. A strong program featured the meeting which included as distinctive features certain round-table discussions, one on effect

Editor's Note.—The accompanying article includes news accounts of several recent meetings of certain standing committees, discussing the more important actions taken at some of these meetings. In so far as possible, an attempt is made in the Bulletin throughout the year to give accounts of committee meetings so that all members of the Society may have current news of what has transpired.

of sub-atmospheric temperatures on the properties of metals, one on fundamental methods and technique of spectrochemical analysis, a very well attended one on freezing-and-thawing tests, and another conference on accelerated weathering tests. The Symposium on Paint Testing was interesting—the papers are summarized in this BULLETIN. A review of the *Proceedings*, which will be mailed soon, indicates the important topics covered in other authoritative papers and reports presented at the meeting.

The Society's Fifth Exhibit of Testing Apparatus and Related Equipment which is a feature of the meetings held in the odd-numbered years afforded members and visitors an opportunity to inspect latest developments in this field. Several Society committees sponsored interesting displays of their work.

The Second Photographic Exhibition sponsored by the Society resulted in many favorable comments, an unusual number of outstanding photographs being displayed indicating the very excellent work which many of the members of the Society are doing in this field. A number of prize-winning photographs have been published in the BULLETIN.

The Spring Meeting, held in Columbus in March, featured two technical symposiums, one on lime and one on thermal insulating materials, both resulting in much valuable and authoritative data which have been issued in two special publications aggregating some 125 pages each, 11 papers comprising the lime symposium and four the thermal insulating, each publication giving considerable discussion (see another page of this BULLETIN for comments on the published lime symposium).

It is interesting to note that during A.S.T.M. Committee Week, held in Columbus, there were 149 committee meetings and during the Annual Meeting in June there were some 250 committee meetings. While the exact number of committee sessions, including subcommittees and sections, has not been totaled for any particular year, it is obvious that with many committees holding sessions throughout the year in two- or three-day sessions, independent of the spring and annual meetings, the total is probably in excess of 500.

Several interesting local or district meetings were sponsored by district committees in various industrial centers: Detroit, Cleveland, Los Angeles, Chicago (2), New York and St. Louis. A number of the technical papers at these meetings have been published in the BULLETIN during the year, including the papers in the symposium held at the Detroit meeting on Industrial Applications of New Testing Methods and the paper by Arthur W. Carpenter on "A.S.T.M. in the Rubber Industry" presented at the Cleveland District Committee meeting.

EXTENSIONS OF COMMITTEE WORK

While no new standing committees were organized during the year as was the case in 1938 (Committees E-7 on Radiographic Testing and C-16 on Thermal Insulating Materials having come into being that year), many of the existing committees set up new sections and subcommittees and a new standing committee on sulfur cements was authorized—formal organization to be perfected during 1940. Among the leading new groups is the Section on Automotive Rubber Products under the direction of Committee D-11 with the Society of Automotive Engineers closely cooperating in this important activity. The reports of the standing committees to be published in the *Proceedings* and the material, which follows covering various committee activities, will indicate new subcommittees and sections.

PUBLICATIONS

While the paramount publication credited to 1939 will be the Book of Standards, the *Proceedings* aggregating some 1300 pages (see another page of this BULLETIN), the ASTM BULLETIN, Year Book, and Index to A.S.T.M. Standards and Tentative Standards were also of importance, the BULLETIN continuing the policy of gradual expansion, the six 1939 issues comprising more pages published than in any other year, including some 160 pages of technical papers and reports which were brought to the members currently and which published in the *Proceedings* would aggregate some 200 pages. The several compilations of standards on petroleum products, textile materials, rubber products, cement, pipe and piping materials, and electrical insulating materials were issued with several special technical publications including the symposiums on thermal insulating materials and lime, the wire test report of Committee A-5 on Corrosion of Iron and Steel and the publication, "Evaluation of Petroleum Products."

RESEARCH

The October BULLETIN carried a brief résumé of several new important research projects, the total number of these investigations some of which have been in progress for many years involving properties and testing of materials being more than 150. New projects involve the field of magnetic properties, preparation of a pictorial rusting scale for evaluating rust resistance, and others involving petroleum, mineral fillers, automotive rubber, rubber life tests, and textile finishes.

Further details of the Society's standardization and research activities and related topics are given in the statements which follow. In this material, the major advances in 1939 are recorded, but the material primarily stresses work under way or what with normal progress can be expected during the coming year.

Steel

Without question the past year was one of the most active ever experienced by the Steel Committee, not only in studying and bringing up to date 100 specifications but also from the standpoint of new work accomplished. In the latter connection it is of interest to note the new tentative specifications, six of which cover various types of carbon and alloy-steel spring wire, three pertain to the field of pipe and tubing—in particular, boiler and superheater tubes—three cover castings for miscellaneous industrial uses and for services at high temperatures, these latter three prepared especially from the standpoint of suitability for fusion welding.

While the recommendations of the committee covered the adoption as standard of 9 specifications, the fact that one of these involves two A.S.T.M. specifications which

are probably used as widely as any and at the same time are the oldest specifications the Society had on its books, having been first issued in 1901, is of unique interest. This action involved the consolidation of the Specifications for Steel for Buildings (A 9 – 36) and the Specifications for Steel for Bridges (A 7 – 36) into a new standard—Specifications for Steel for Bridges and Buildings (A 7 – 39). This change essentially means that the somewhat higher grade of steel provided for in the bridge specifications will be used in building and related structures. A large number of revisions (some 25) in specifications were adopted, some of them having been published previously, others developed during the year.

JANUARY, 1940 MEETINGS

A number of important recommendations will be submitted to the Society as the result of a series of meetings held by Committee A-1 on January 8 and 9 in Philadelphia. All of these items are, of course, subject to committee letter ballot. In some cases, subcommittees also must be canvassed by formal ballot.

There is intensive interest in the question of weldability; the group responsible for work in the field of structural steel discussed this subject at considerable length. The subcommittee also recommended minor changes to bring the number of tests section in Specifications for Steel Plates of Structural Quality for Forge Welding (A 78) and the Specifications for Structural Steel for Locomotives and Cars (A 113) in line with other structural specifications. In the former the sulfur maximum is to be raised from 0.05 to 0.055 per cent to bring this in conformity with commercial classifications.

Subcommittee III on Steel for Ships reaffirmed its previous decision to eliminate from the Society's specifications the standard covering Specifications for Marine Boiler Steel Plates (A 114 – 33) which had been dropped last year subject to later consideration as to whether it should be brought up to date.

There was considerable activity in the field of forgings. Two sections on carbon-steel forgings reported agreement on specifications, one covering products of primary interest in the field of railroads, the other concerning chiefly the industrial and commercial type forgings. These are to be referred to letter ballot of Subcommittee VI on Steel Forgings and Billets and subsequently to Committee A-1. At the same time ground work was laid for the development of specification requirements for alloy-steel forgings for railroads and for commercial forgings. This work will eventually result in four A.S.T.M. specifications in this field, thus clarifying the present conflicting requirements in five or six different specifications.

Intensive work in the field of pipe and piping materials continued with a large number of recommendations from Subcommittee IX involving the addition of new alloys in various specifications and other modifications to bring requirements in line with commercial practice; detailed consideration of hardness values and method of measurement; and the question of testing and bursting pressures of pipe and tubing. It is expected that a very extensive table in connection with this latter subject will be submitted with committee comments and explanations for publication in the ASTM BULLETIN. The subject is of prime importance to all consumers, producers, designers, etc., of pipe.

One of the very important results of the meeting was the decision on the part of Subcommittee XXI on Steel for Welding to refer to its members for letter ballot specifications covering iron and steel arc welding electrodes. Coincident with the approval of this specification as an A.S.T.M. tentative standard the existing Specifications A 205 – 37 T covering Iron and Steel Filler Metal (Arc-Welding Electrodes and Gas-Welding Rods) will be withdrawn. The proposed specifications will provide requirements for electrodes for use with carbon and low alloy steels of welding quality, the electrodes being classified on the basis of the ultimate strength and usability.

The specifications were developed jointly through Subcommittee XXI and the Filler Metal Specifications Committee of the American Welding Society.

There was considerable activity by Subcommittee XXII on Valves, Fittings, Piping, and Flanges for High-Temperature Service. The Section on Welding Fittings reported practical completion of new specifications and the sections on pipe, castings, and forgings brought in definite recommendations involving changes in various requirements, details of which will appear in the 1940 report of the committee. Since most of the changes in the form of revisions offered by this subcommittee, Subcommittee IX, and others are considered to be of an important nature, it is planned to submit them to the Society at the 1940 Annual Meeting and subsequent ballot for adoption this year.

Wrought Iron; Cast Iron Malleable Iron Castings

Three specifications covering wrought-iron plates (A 42), rivets and rivet rounds (A 152), and shapes and bars (A 207) were adopted as standard through the work of Committee A-2 on Wrought Iron and revisions which had been pending in some seven specifications were adopted.

Of chief interest in the field of cast iron was the approval as tentative of two specifications, perhaps considered as replacements of existing standards. The first covers cast-iron pipe and special castings (A 44) replacing a specification which had stood for 35 years without change; the second is a specification for cast-iron soil pipe and fittings, replacing the present standard A 74.

Committee A-3 is considering the type of test specimens most desirable in connection with work on chilled and white-iron castings and is also studying a possible revision in the requirement for breaking load in the transverse test value for Class No. 60 castings.

The new specifications for pearlitic malleable-iron castings (A 220) were developed by Committee A-7 on Malleable-Iron Castings. They classify this material not covered by other existing A.S.T.M. specifications in respect to tensile properties. Specifications for cupola malleable iron (A 197) tentative since 1936 were adopted as standard. In connection with the specifications for pearlitic malleable an attempt to develop further information on physi-

(Continued on page 43)

Symposium on Paint Testing

The papers summarized below were presented in connection with a Symposium on Paint Testing sponsored by Committee D-1 on Paint, Varnish, Lacquer, and Related Products at the 1939 A.S.T.M. Annual Meeting in Atlantic City. The special D-1 committee in charge was headed by G. G. Sward, Chemist, National Paint, Varnish and Lacquer Assn., Inc.

Committee D-1 has maintained, since its organization in 1902, a very real and sincere interest in the promotion of knowledge and testing of the properties of materials under its jurisdiction. Since 1904 when the first formal technical papers on paint appeared in the Society's *Proceedings*, namely, one by Robert Job on "Results of an Investigation of Certain Structural Paints," and one by Cyril De Wyrall on "Preservative Coatings for Iron and Steel," the members of the committee have presented at Society or committee meetings a large number of technical contributions. Several formal technical symposiums have been sponsored by the committee including the Symposium on Paint Materials held at the 1935 Regional Meeting in Philadelphia and the Symposium on Correlation Between Accelerated Laboratory Tests and Service Tests on Protective and Decorative Coatings held at the 1937 Annual Meeting in New York.

Some of the most extensive research investigations carried out under Society auspices were sponsored by Committee D-1, including the comprehensive tests on paints known as the Havre de Grace bridge tests, the tests at Atlantic City on wooden panels, and others.

At the present time Committee D-1 has in its charge some 101 standard and tentative specifications, tests, and definitions covering a wide range of paints, varnish, lacquer, and related products.

That the committee's interests and activities are constantly expanding to cover the new materials and methods that research is providing is exemplified by the 41 recommendations pertaining to standards that appeared in this year's report. Within its seventeen active subcommittees, and numerous subgroups, ideas are constantly being advanced regarding new approaches to the establishment of acceptable testing procedures upon which its specifications are based.

It is through such contributions as the 1939 Symposium on Paint Testing that Committee D-1 is endeavoring to further the aims of the Society in the promotion of knowledge of engineering materials. The papers in this symposium deal with micellaneous tests or testing devices. Some of the presentations are already embodied in A.S.T.M. standards; others are not. All of them lead to a better understanding of various problems in the field of paint testing and recognition of the important work of the committee.

Some Fundamental Requirements of Colorimeters and Reflectometers

By Richard S. Hunter[1]

The colorimeters and reflectometers are instruments designed to furnish data which may be successfully correlated with visual estimates of the color of samples measured. The problem of specifying color stimuli is three-dimensional. For instance, the three dimensions provided by the well-known Munsell Color System are hue, value, and chroma.

The conversion of physical measurements of radiant energy to specifications of color is achieved by using the I.C.I. standard observer for colorimetry, a fictitious observer whose response characteristics are defined in physical terms. This observer was defined so that, in equating mixtures of color stimuli, he corresponds to an average human observer with normal color vision. Color specifications in terms of the I.C.I. standard observer may be derived by computation from spectrophotometric specifications, or they may be obtained by direct measurement using suitable tristimulus colorimeters, either visual or photoelectric. In the photoelectric instrument, it is necessary that the spectral characteristics of the standard observer be duplicated in source-filter-photocell combinations, the general reliability of results depending on the accuracy of the duplication. It is extremely important that this requirement be satisfied when building colorimeters and reflectometers. Methods for representing intelligibly color stimuli measured by a tristimulus method were described at the meeting.

[1] Physical Science Aide, National Bureau of Standards, Washington, D. C.

A Method of Representing Color

By Francis Scofield[1]

One of the systems of recording color measurement which has been proposed involves two coordinates, α and β, which are derived from readings on the Hunter reflectometer, but may also be derived from tristimulus values. These coordinates give an equal-chromaticity field which, with the brightness, comprises the entire three-dimensional color space.

For many problems of color measurement and change, a slightly different coordinate system is desirable and may be derived readily. The polar coordinates, direction and distance, derived from α and β correspond fairly well to the well-known Munsell system of hue and chroma, so that by expressing color in this manner, color may be visualized from the numbers, which is a little difficult in the α–β system.

In many of the changes observed in paints, the hue is essentially constant. The graph of distance against brightness, or a vertical plane through the origin of the system, permits color change to be expressed in a two-dimensional graph. Such problems as yellowing, fading, etc., are all of this character. In many cases the brightness may be neglected since it is widely affected by extraneous phenomena, such as dirt collection, and surface changes. In these cases, distance may be plotted against

[1] Chemist, National Paint, Varnish and Lacquer Assn., Inc., Washington, D. C.

time, or some similar variable, and the change in color may be followed.

By reducing the change to a single number, numerical comparisons between various samples are possible. Thus the amount of yellowing after a certain procedure may be defined by a single number. Similarly, the color of dried varnish films may be expressed numerically.

In the case of fading, the ratio

$$\frac{\text{original distance} - \text{final distance}}{\text{original distance}} \times 100$$

may be called "per cent fading."

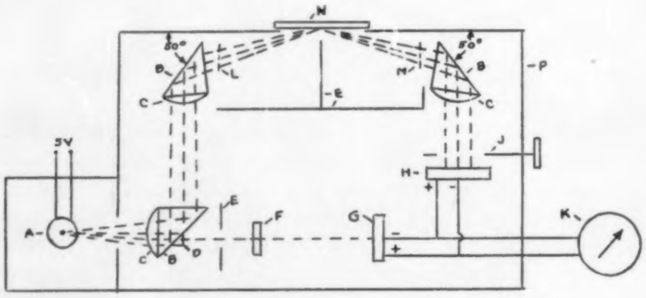
Tinting strength, likewise, may be recorded as the distance of a point representing the blend of the unknown pigment and a standard from the origin. Experiments have indicated that results obtained in this manner correlate very well with those obtained by the A.S.T.M. Standard Method of Test for Mass Color and Tinting Strength of Dry Color Pigments or Pastes (D 387).

A number of similar uses for this method will be obvious to any one engaged in paint or varnish testing. Some numerical method for defining color, independent of visual judgments, is obviously needed by the paint industry and this method appears to fulfill the requirements.

A Sheen Meter

By J. W. Ayers[1]

Many low gloss paints, when viewed at grazing angles, exhibit a glossiness commonly known as sheen. This property is important in the evaluation of flat and eggshell paints in that it is to a degree a measure of pigment dispersion and film porosity. It has been determined that sheen exists at angles of incidence greater than 75 deg., and although there are available glossmeters for the measurement of gloss at 45 and 60 deg., none of these is especially adapted to measuring at grazing angles. Sheen and gloss of a given paint are not necessarily proportional; for example, one paint

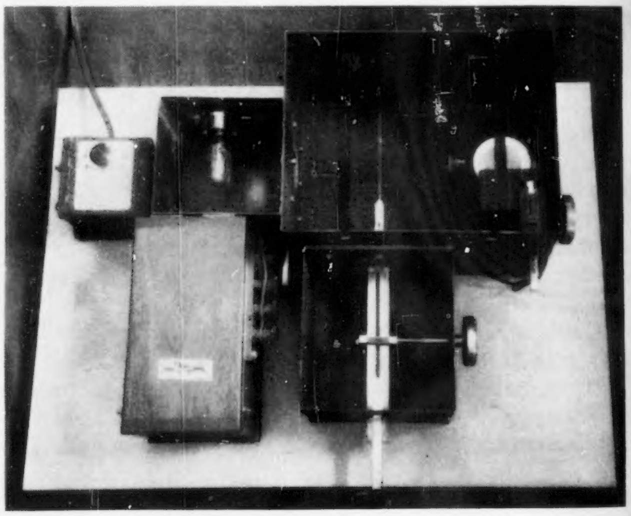


may have a gloss of 38 per cent at 60 deg. and another a gloss of only 10 per cent, yet the sheen at 80 deg. may be 76 per cent for both.

The sheen meter, shown in the accompanying sketch and photograph, consists essentially of: (1) a light source; (2) an optical system of prisms, lenses, and slits to focus the light on the specimen at angles of 75, 80, and 85 deg.; and (3) a measuring system consisting of two photocells, a calibrated optical wedge having a 0 to 100 per cent transmission, a balancing diaphragm, and a galvanometer.

A portion of light from the source falls on one cell in front of which is the optical wedge, and the light reflected from the specimen on the other. The two cells are connected in a balanced circuit so that equal quantities of light falling on them will produce no galvanometer deflection.

In operation a standard glass having a sheen of 100 per cent is placed on the instrument with the slits set at the desired angle, and the meter balanced with a wedge setting of 100 per cent by means of the balancing diaphragm in front of the second photocell. The standard glass is re-



placed with the sample to be measured, and the meter again balanced by moving the optical wedge which controls the light falling on the first photocell. The balance point is indicated by the galvanometer, and the percentage of sheen read directly from the calibrated scale attached to the wedge.

The accuracy of the instrument is about 0.2 per cent, and the time required for each reading, neglecting balancing with the standard is from 30 to 60 sec.

[1] Director of Research, C. K. Williams and Co., Easton, Pa.

Testing Elasticity and Hardness of House Paints

By W. H. Hoback[1]

An accelerated test for hardness and adhesion characteristics of house paint finishes is effected by the application of one or more coats on 1-in. cedar panels with slots cut into the sides to admit water. Moisture pressure and dimensional fluctuation of the wood thereby exert a strain upon the paint film, and its resistance to these strains is demonstrated by its ability to

[1] Titanium-Pigment Co., New York, N. Y.

withstand cracking, flaking, peeling, and other forms of serious paint film breakdown.

Past experience has shown this method to be a quick and sufficiently accurate procedure for predicting paint performance and which is further checked by vertical and 45-deg. exposure tests, prepared according to the usual testing procedures.

This method of accelerated testing has proved to be sufficiently flexible for evaluating the performance of a single coat of paint and various combinations of this paint and other types which may differ in hardness and other properties. The results thus obtained can be differentiated into effects caused by each individual paint and the purpose for which it is used, that is, as a priming coat for other paints, and as a finishing coat over a priming coat of different nature, or over itself as a primer. The accompanying Figs. 1 to 4 demonstrate these tests. A comparison of Fig. 4 with Figs. 1, 2, and 3 will afford an estimate of the size of the break created by the strains exerted upon this composite brittle film.

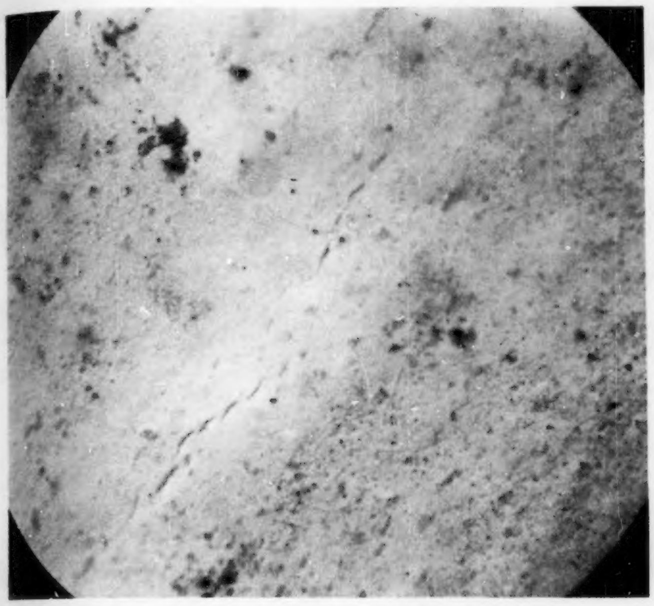


Fig. 1.—View Showing Integrity of an Elastic, Adhesive Single Coat Film (×50).

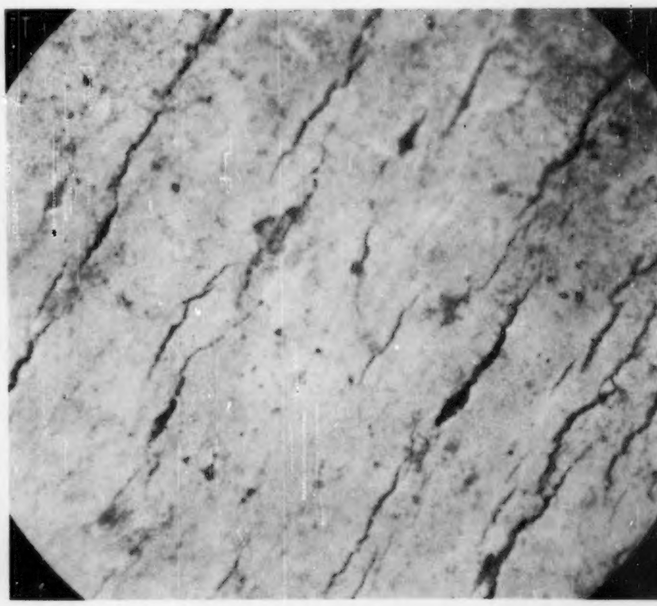


Fig. 2.—View Illustrating Cracking and Contraction of a Hard, Brittle Single Coat Film (×50).

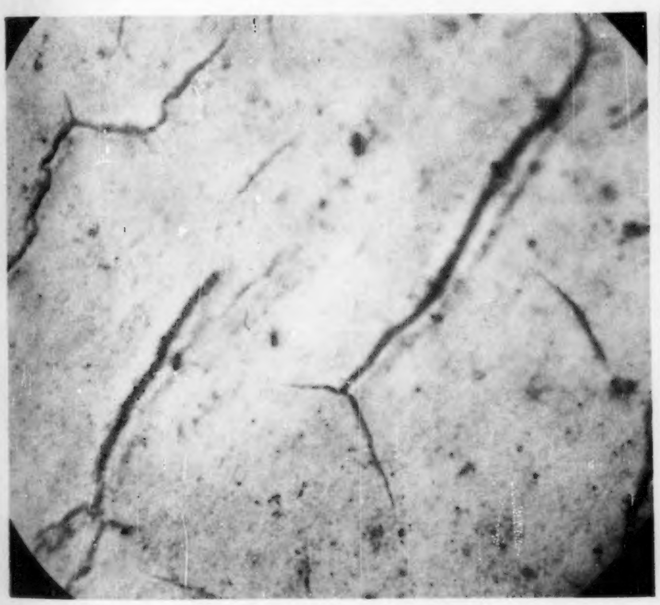


Fig. 3.—View of Improved Adhesion Resulting from Use of the Paint in Fig. 2 as Priming Coat for Two Finishing Coats over Fig. 3 Type Paint (×50).

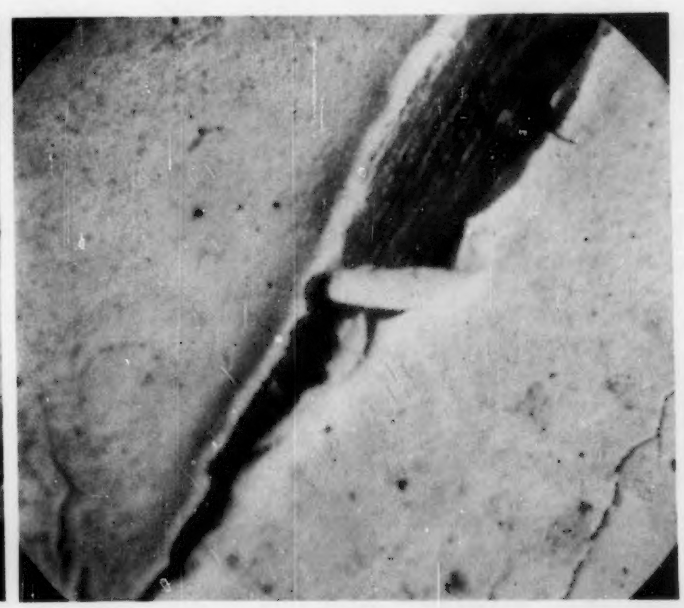


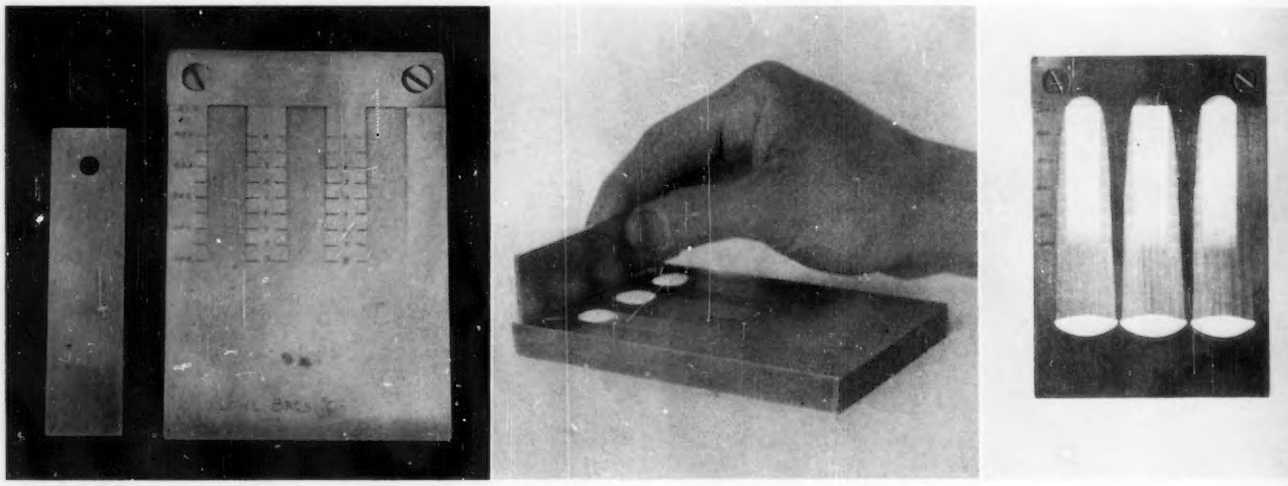
Fig. 4.—View Showing Cracking and Loss Adhesion Characterized by Three Coats Self-Primed over Fig. 3 Type of Paint (×50).

The Hegman Fineness Gage

By E. W. Fasig[1]

THE VALUE of the Hegman fineness gage is in factory control. In most laboratory work where extreme accuracy is required, it is doubtful whether the gage will answer the purpose.

The gage is made of low-carbon steel, the surface of which is case hardened to a depth of $^1/_{16}$ in. The face of the block is machined, assembled, and then ground and polished. On the face of the block three wedge-shaped channels $^1/_2$ in. wide and 2 in. long are cut lengthwise with the block. These channels taper from a depth of 0 in. to 0.005 in. The calibration lines are arranged from 0 to 8 inclusive, and are placed along the channels at each increase in depth of 0.0005 in. beginning with 0.004-in. depth.



Paints to be tested must first be thinned to the average paint consistency. The fineness of paste paints cannot be accurately determined until after the pastes are thinned to an average liquid paint consistency.

In making the fineness test, a few drops of the paint are placed in the deepest part of one channel. The standard for comparison is placed in one of the other channels. These are then drawn down lengthwise by means of a scrapper blade as shown in the accompanying photographs. To make the reading, the gage is held at almost eye level, face up, and the paints are viewed at an angle. At some point the pigment particles will protrude above the surrounding surface. This point is taken as the measure of the fineness.

[1] General Superintendent, The Lowe Brothers Co., Dayton, Ohio.

The Aeration Test for Comparison of Thinners

By D. D. Rubek[1]

THE AERATION test gives a comparative measure of the aeration resistance of film-forming mixtures such as paint, varnish, cement, ink.[2]

By aeration resistance is meant the ability to withstand bodying and precipitation. Bodying, as referred to here, may be due apparently to loss of volatile as well as oxidation and polymerization. Precipitation may be due apparently to increasing insolubility of nonvolatiles.

The samples are placed in open containers of the same size and shape and stirred simultaneously with a multiple stirrer (Fig. 1). A high-speed, 12-in. fan can be used to blow a stream of air across the samples. Care is taken to place the fan so that apparently the same amount of air is blown across each sample. The position of the fan is determined by preliminary tests with the same material in each container.

At intervals stirring is stopped, the samples are examined for viscosity increase, and the volatile matter lost is replaced. The tendency for seediness or precipitation can be noted by pouring the samples on glass plates and examining by looking through the films. The samples are again repeatedly stirred, noted for viscosity, loss replaced, and noted for precipitation tendency. The following is a typical example.

PHYSICAL CHARACTERISTICS OF PETROLEUM THINNERS USED

In this typical example, white undercoat was thinned: equal volumes of thinner to undercoat. In one case thinner A was used, and in the other case thinner B was used. These are petroleum thinners made by straight-run distillation. The physical characteristics of the thinners used are as follows:

A.S.T.M. Distillation

	Thinner A	*Thinner B*
Initial	194 F.	238 F.
50 per cent	252 F.	260 F.
Dry point	318 F.	288 F.

[1] Director, Chicago Research Division, Anderson-Prichard Oil Corp., Oklahoma City, Okla.

[2] H. A. Gardner, "Physical and Chemical Examination of Paints, Varnishes, Lacquers and Colors," Eighth Edition, p. 620.

Cleveland Club Paper, Scientific Section, National Paint, Varnish and Lacquer Association, Inc., Circulars Nos. 546, 568, "Tests for the Stability of Dipping Varnishes and Enamels."

Comparative Spot Dry Time

Thinner A	$1^3/_4$ min.
Thinner B	$1^1/_2$ min.

Kauri Butanol Solvency

Thinner A	36.2 ml. to 20 g. K.B. solution
Thinner B	37.5 ml. to 20 g. K.B. solution

EVAPORATION LOSS UPON AERATION

200-ml. samples of each of the freshly thinned undercoats were subjected to the aeration test. A fan was used to blow a strong current of air across the containers. At the end of each hour of stirring, make-up thinner was added to bring the sample to original weight. The make-up thinner was added from a buret.

Make-up thinner required was noted as follows:

	Make-up Thinner Added, ml.	
	Undercoat Thinned with A	Undercoat Thinned with B
First hour	25.6	18.4
Second hour	23.4	17.9
Third hour	22.3	17.4
Fourth hour	21.8	17.0
Fifth hour	21.3	16.7
	114.4	87.4

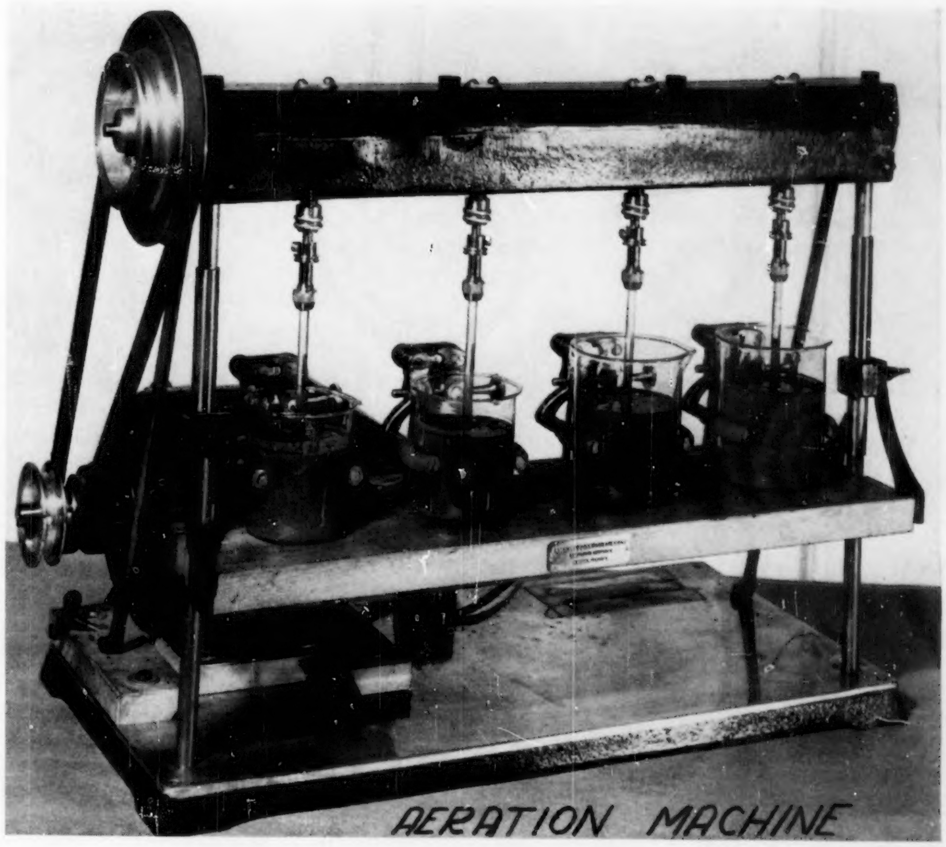


Fig. 1.

CHANGE IN VISCOSITY UPON AERATION

After each hour of aeration, before and also after make-up thinner was added, the undercoat samples were com-

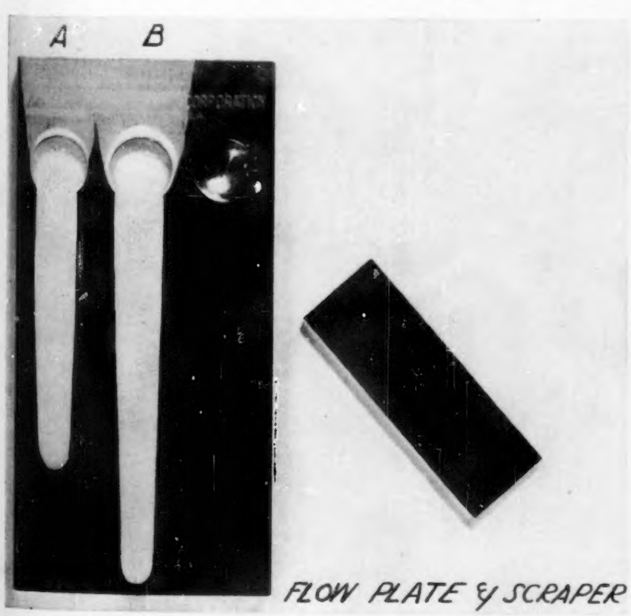


Fig. 2.

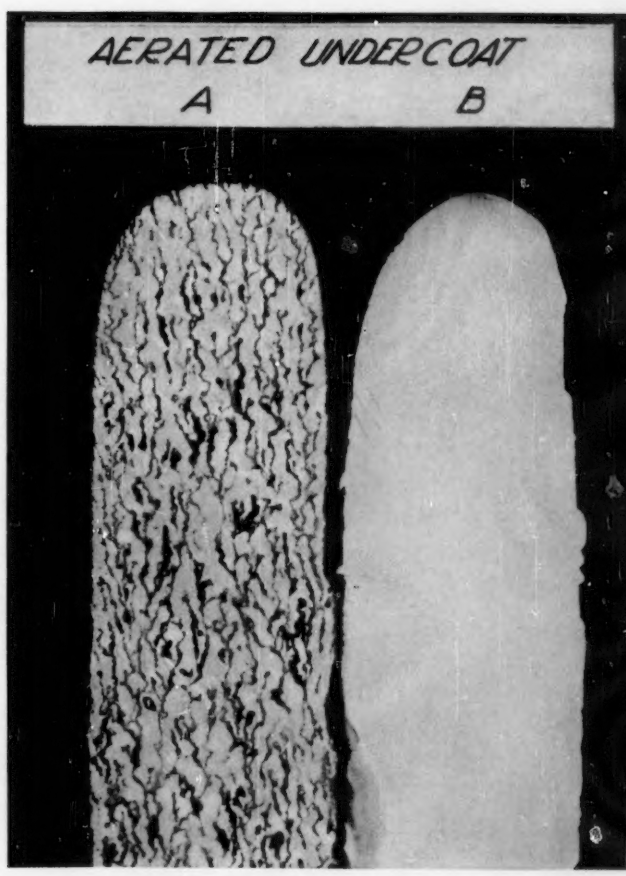


Fig. 3.

pared for viscosity on the aluminum flow plate. By means of a doctor blade the hollows near the end of the aluminum plate are filled level full with the undercoat samples. By tilting the plate the undercoat flows from the hollows and down the plate. Comparative viscosity is judged by the speed of the flow (see Figs. 2 and 3).

It was noted that the undercoat thinned with B thickened noticeably less than the undercoat thinned with A. Thickening results in decreased coverage per gallon of the undercoat.

RESISTANCE TO BREAKDOWN UPON AERATION

The samples were aerated further to note for precipitation, and make-up thinner was added at $^1/_2$-hr. intervals. At the end of one more hour of aeration and make-up, the undercoat thinned with A had broken down while the undercoat thinned with B did not appear to be broken down. At this stage, the solid portion of the undercoat thinned with A appeared to be insoluble and immiscible with the liquid portion.

The undercoat thinned with B was then aerated still further. After $2^1/_2$ hr. more of aeration and make-up, the undercoat thinned with B had broken down.

Comparative resistance to breakdown is indicated by length of time the sample had been aerated when breakdown occurred.

	Breakdown, hr.
Undercoat thinned with A	6
Undercoat thinned with B	$8^1/_2$

CONCLUSION

This test can be used to determine comparative amount of thinner loss, comparative thickening, and comparative resistance to breakdown of film-forming materials. From the data as shown, the type of thinner used can apparently make a difference in thinner loss, thickening, and resistance to breakdown.

Detective Work on Metal Finishes

By V. M. Darsey[1]

In many instances where premature failure of paint finishes occurs, it can be traced to the presence of some activator on the surface of the metal prior to painting. The presence of hand marks, dirty rag marks, chalk marks, rinse streaks, water and alkali spots, to mention only a few of such conditions, is sufficiently active to account for many such paint failures. The detection and avoidance of such conditions on the surface of objects prior to painting is a primary requisite in any successful paint procedure.

Since some of these activators are invisible, advantage is taken of their property when in contact with moisture to form blisters in the paint film at the contaminated areas for their detection. Exposing painted articles inside a cabinet at 100 to 110 F. with 96 to 100 per cent relative humidity, or immersing them in water at this temperature, is used as an accelerated test for detecting such conditions. The nature and characteristics of the blistered area (see Figs. 1 and 2) in the paint film are generally sufficient evidence to determine the source of the contaminating factor. Once the cause is ascertained, it can be immediately remedied with the result that the producer avoids any finished articles getting into service which might fail prematurely and thus avoids expensive refinishing charges.

[1] Technical Director, Parker Rust-Proof Co., Detroit, Mich.

Fig. 1.—Ordinary White Chalk Mark on Plain Steel Surface.

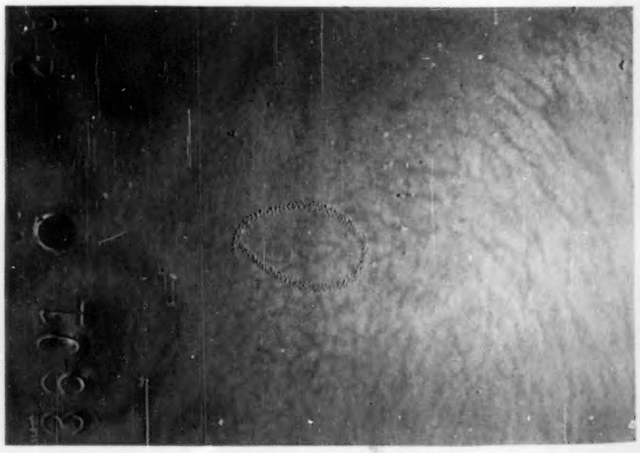


Fig. 2.—After Applying Paint over the Entire Panel Containing the Chalk Mark and Subjecting the Panel to Humidity Test, Pronounced Blistering Is Observed at the Area Containing the Chalk Mark.

An Apparatus for Determining the Durability of Heat-Resisting Paints

By G. W. Ashman[1] and S. Werthan[1]

There is an obvious need of a reliable method for selecting serviceable paints for use on heated metal surfaces fully exposed to the weather and to industrial atmospheres. An apparatus designed for this purpose has been constructed and successfully used (Fig. 1).

The test equipment consists of a cylindrical electric heating unit, suitably mounted, replaceable test sections, 3 in. in diameter by 32 in. long, of sheet metal pipe that entirely cover the heater, and racks for unheated outdoor exposure of these pipe sections. Temperatures ranging from 300 to 900 F. are obtained.

It is considered an essential feature of the test that the apparatus is mounted, outdoors, in an upright tilted position, sloping toward the south. Several paints are applied, in bands, on the sheet metal pipe, a paint of known behavior being included as a standard of comparison. The current input is regulated to obtain a rapid initial failure, after which the tube is removed to the adjacent wooden racks, arranged in the same position as the heater, and the outdoor exposure at normal temperature is continued for some time. The alternation between hot and cold exposures may be repeated several times. The test is an accelerated one, since the finish fails at a considerably faster rate than in actual industrial service.

In a 1-yr. trial of this apparatus very informative and reliable data have been obtained.

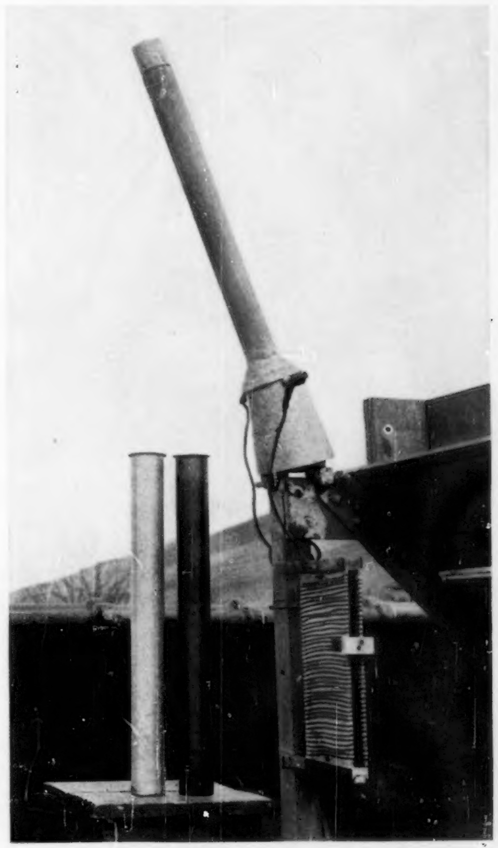


Fig. 1.—Test Unit and Two Test Exposure Cylinders.

[1] Investigator, and Chief, respectively, Paint Section, Research Division, The New Jersey Zinc Co., Palmerton, Pa.

The Conical Mandrel for Measuring Elongation of Attached Films

By H. G. Arlt[1]

The conical mandrel test for measuring the elongation of attached organic coating films has been described and discussed in a paper appearing in the December, 1937, issue of the ASTM Bulletin. Control of film thickness and environment at the time of test are quite important. Data were presented at the meeting on elongation results obtained by various laboratories in a cooperative study of the device and test method. The operation of the test was demonstrated in a motion picture shown at the meeting which also demonstrated the operation of an air-blast type abrasion test, an impact test, and a means of preparing organic finish test specimens to predetermined and uniform controlled thickness.

Note.—A Method of Test for Elongation of Attached Lacquer Coatings with the Conical Mandrel Test Apparatus (D 522 – 39 T) was approved at the 1939 Annual Meeting. This tentative method appears in the 1939 Book of A.S.T.M. Standards, Part II.

[1] Member of Technical Staff, Bell Telephone Laboratories, Inc., New York City.

Cook Box Test for Anti-Corrosion Paints

By E. W. McMullen[1]

The cook box, originally developed for testing refrigerator and similar finishes subjected to high humidity and corrosive action, has been adopted by us for testing outdoor paints such as red lead and blue lead. The box itself may be of any desired size for the number of panels to be tested. Our particular equipment is about 4 ft. long, 2 ft. wide, and $1^1/_2$ ft. deep. The interior is entirely lead-lined and has 5 rows of small copper tubes running from one end to the other, and bent to form a vertical coil on either side of which test panels can be hung. Through these thin copper tubes, $^1/_8$ in. in diameter, cold water is continuously circulating. The backs of the panels rest against these cold tubes.

The bottom of the lead-lined chamber carries 2 or 3 in. of water externally heated to a definite temperature by recirculation through an automatic electric heater. The vapor rising from this hot water maintains the inside tem-

[1] Director of Research, The Eagle-Picher Lead Co., Joplin, Mo.

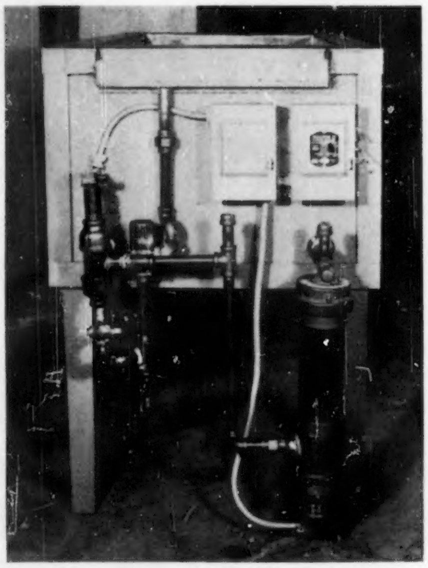


Fig. 1.—Arrangement of the Temperature and Water Level Controlling Equipment.

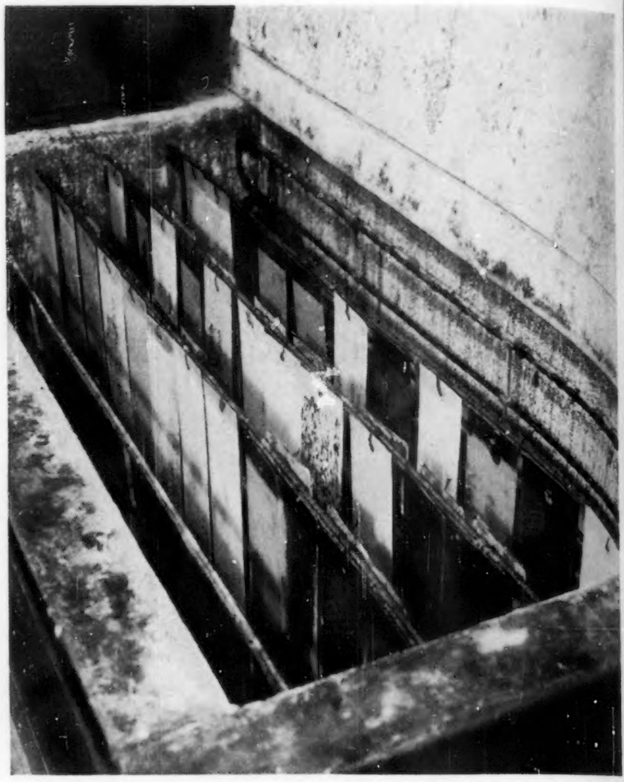


Fig. 2.—Interior of the Box, and Panels Undergoing Test. Note the blistering, peeling, and rusting shown by some of the panels. The interior of the box itself is not painted; its white appearance is due to superficial carbonation of the sheet lead lining

perature of the box at 120 F. The action of the cook box is a continual exposure of the test panels to saturated air at 120 F. and, at the same time, condensation from this same air is continually washing down the face of the panel.

Vehicles having the slightest tendency to decompose under humid conditions do so very rapidly in the cook box. Results in duplicate tests check quite accurately, since conditions can be maintained indefinitely. We find, however, that regular outdoor corrosive conditions can be best duplicated by a combination of a cook box test and an accelerated weathering machine test. Our present schedule, therefore, for paints such as red lead and blue lead, is to expose them in the cook box for a week and then in the accelerated weathering machine for one week, repeating the two operations until the decomposition of the film is sufficiently complete for the purpose of the test. Results from such cycles will be correlated with outdoor exposure tests as rapidly as possible.

Development of a Consistency Test

By R. H. Sawyer[1]

Consistency of a paint is easily observed by stirring with a spatula. For purposes of classification, a system of designating consistency numerically was developed in the Krebs laboratories. Subsequently, the action of the spatula was made mechanical by using a forked rotor on the Stormer viscometer (Fig. 1). Using this forked rotor and a rotational speed of 200 r.p.m., conditions were established which appeared to duplicate hand stirring quite well. A series of paints was lined up according to individual gradings on this arbitrary consistency scale. The weights required to give 200 r.p.m. on the forked rotor were then correlated with consistency on the arbitrary scale.

Since it is not always convenient to operate the Stormer at exactly 200 r.p.m., correlation tables were set up to show relation in Stormer consistency units of weight *versus* speed for rotational speeds from 150 to 300 r.p.m. These correlation tables are, of course, inaccurate in comparing paints differing in false body characteristics. Al-

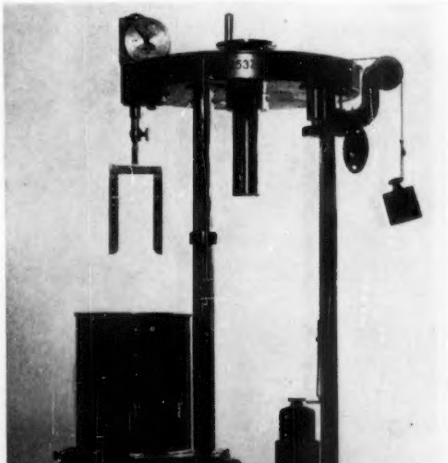


Fig. 1.—The Stormer Viscometer with Forked Rotor.

[1] Krebs Pigment and Color Corp., Newport, Del.

though this correlation was strictly empirical, it was subsequently found that the consistency scale was a sensation scale, that is, there is a linear relation between consistency on the arbitrary scale and the logarithm of the weight required to operate the Stormer rotor at a constant speed. The arbitrary consistency scale is thus a useful scale, since it expresses differences in consistency in terms of the difference appearing to the person handling the paints. The Stormer viscometer with forked rotor, however, has been investigated for measuring consistency of paints by a work committee of Subcommittee VIII on Methods of Analysis of Paint Materials, Committee D-1, and has been found quite satisfactory for measuring consistency of enamel type paints. A method is being proposed based upon the use of the Stormer viscometer. This method will express consistency not as a sensation unit, but as driving weight required to give 200 r.p.m. on the Stormer rotor, since this appears to be a more convenient method of expression. Although not included in the work of this committee, the Stormer rotor has been further modified to make it more suitable for use in false bodied paints, where the forked type rotor cuts a groove and does not make a satisfactory measurement. The new rotor is a submerged two-bladed paddle. Results with this rotor duplicate results with the forked paddle in paints of little or no false body.

Improved Sight Gage for A.S.T.M. Tests for Burning Quality of Kerosine Oils

By T. H. N. Waite[1] and M. M. Rhodes

IN THE A.S.T.M. tests for burning quality of kerosine oils,[2] while no specific sight gage is required, there is illustrated a single gage that may be employed. It has been recognized by many oil inspectors that this sight gage possesses several inherent disadvantages. The design is such that the entire flame cannot be viewed simultaneously, which makes it difficult to measure a sensitive and flickering flame, and the gage is not adaptable to lamps of varying height except within the limits of the scale divisions. Further, some inaccuracy may result from continued use of the instrument. Recognizing these deficiencies, the authors have developed an entirely different type of gage which has proved to be very serviceable and gives a satisfactory degree of accuracy; it is easy to manipulate, and since it has no moving parts to wear or get out of alignment it is always reliable. The ability to view the entire flame shape with respect to the scale graduations is a particular advantage over other types of sight gages now in use.

The instrument is illustrated in the accompanying Figs. 1, 2, and 3. The original idea developed from the prin-

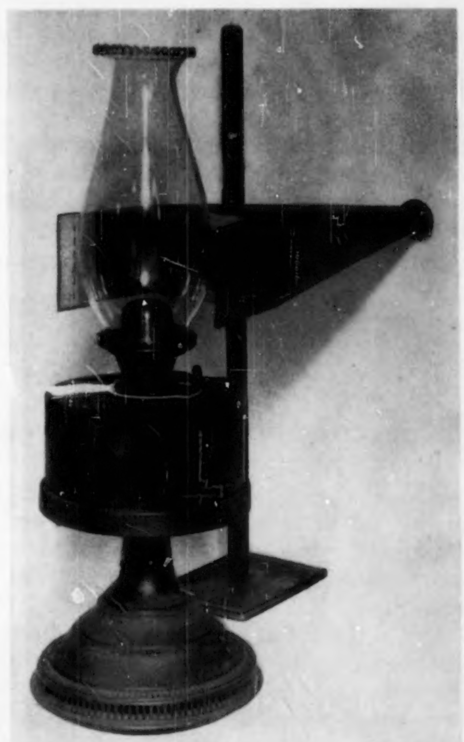


Fig. 1.

[1] Standard Oil Company of California, El Segundo, Calif.

[2] Standard Method of Test for Burning Quality of Kerosine Oils (D 187 – 36), Standard Method of Test for Burning Quality of Long-Time Burning Oil for Railway Use (D 219 – 36), and Standard Method of Test for Burning Quality of Mineral Seal Oil (D 239 – 30), 1939 Book of A.S.T.M. Standards, Part III.

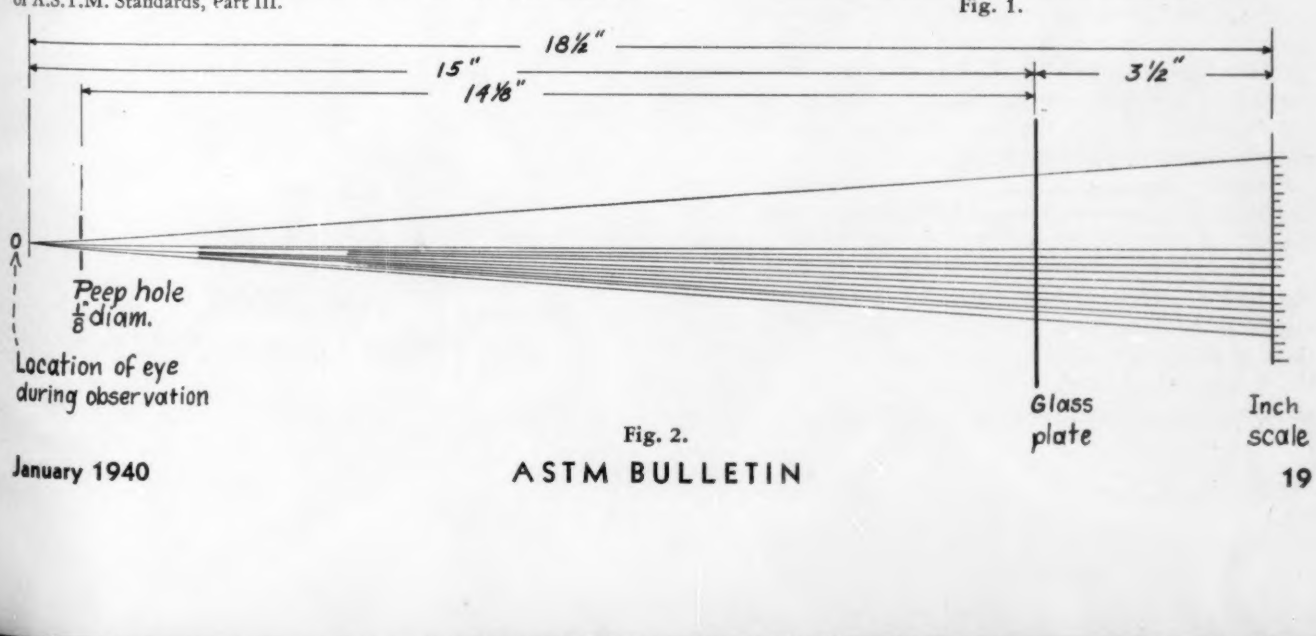


Fig. 2.

ciple of the camera obscura wherein the image of the flame could be measured on a translucent glass plate, the plate being graduated both horizontally and vertically using a suitable scale. A transparent plate was installed between the eye of the observer and the flame by mounting it in the open end of a rectangular wooden box of dimensions 4 by $2^1/_2$ by 15 in., a small peep-hole being provided at the opposite end. The relative distances between the eye, plate, and flame were then established, and two vanes were mounted on the sides of the box, each extending about $4^1/_2$ in. beyond the glass plate. A vertical line was placed on the inside of each vane for the purpose of aligning the gage with the lamp, the vanes extending on either side of the lamp chimney when in position. The original apparatus of wood and cardboard was assembled securely on an iron ring, which in turn was clamped to a ring stand to permit vertical adjustments. As shown in Fig. 1, these have now been replaced by a tapered metal box with a peep-hole eyepiece at the small end and sheet metal vanes. The assembly is finally mounted on an upright metal stand bearing a friction clamp, thus facilitating vertical adjustments.

The essential dimensions are diagrammatically illustrated in Fig. 2. Using this scale ratio of *OG* to *OS* (15 to $18^1/_2$), we may now refer to Fig. 3, which shows the exact size of the glass plate actually used with scale calibrations and numbers. The outline of the flame and burner top has been included to show the relative position of flame and scale when properly adjusted for making flame measurements.

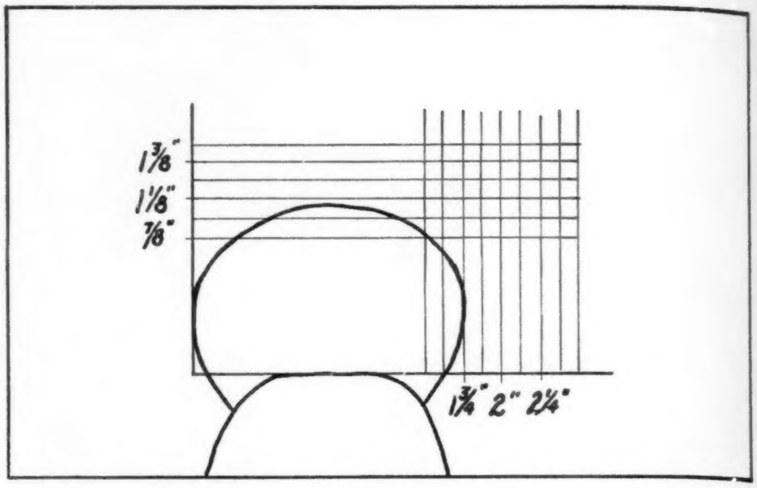


Fig. 3.

In operation, the sight gage is placed in front of the burning lamp, the vanes being on either side of the chimney, and the vertical shadow cast by the lamp falls exactly on the vertical line of each vane. Lateral and vertical adjustments are made to bring the scale to the proper position for measuring the height and width of the flame.

It is hoped that other laboratories will find this gage as serviceable as we have done.

"Engineering Physical Metallurgy"

In the preface to his recently published book "Engineering Physical Metallurgy," Robert H. Heyer, Metallurgist, Research Laboratories, The American Rolling Mill Co., formerly Instructor of Metallurgy, Purdue University, who was awarded the A.S.T.M. Dudley Medal at the 1938 annual meeting, indicates that the volume was designed to aid those making their first acquaintance with metals and alloys. He indicates that although a good deal of valuable, published information is available, there have been few attempts to condense and correlate the various materials, methods, and concepts of metals technology. Considering the great amount of material that is available with consequent offering of many possibilities to deviate from his chief purpose, the author adheres quite closely to the path he laid out.

Covering some 550 pages, including a detailed index, the book involves 15 chapters with the following headings: Pure Metals, Principles of Alloying, The White Metals and Their Bearing Alloys, Light Alloys, Die Castings, Copper and Its Alloys, Iron and Carbon Steels, Heat Treatment of Steel, Low and Medium Alloy Steels, Surface Treatment of Steel, Steel Castings, Welding, Cast Iron, High Alloy Steels, and Tool Steels. At the end of each chapter, the author has compiled valuable lists of references including more recently published papers and reports and books, in some cases as many as 75 being cited. The book includes much data from the publications of various societies including the American Society for Metals, Society of Automotive Engineers, American Institute of Mining and Metallurgical Engineers, Book of A.S.T.M. Standards, A.S.T.M. *Proceedings*, and other technical publications. Copies of the volume, 6 by 9 in., can be obtained from the publishers, D. Van Nostrand Co., Inc., 250 Fourth Ave., New York City, at $4.50 each in cloth binding.

1940 GOLF TOURNAMENT

You're Smart
as a
TRAP
if you guess
what's coming

Service and Life of Non-Ferrous Tubes in Petroleum Refining

By E. S. Dixon[1]

THE USE OF non-ferrous metals for condenser tubes in marine service has been standard for many years. A study of the literature discloses repeated efforts to secure longer life from various alloys among which admiralty metal is found to be the most commonly used. Marine service, however, subjects condenser tubes to much milder service than does petroleum refining; large volumes of relatively cold water are available, the temperature of the metal may be kept relatively low, and the steam side of the tube is subjected to practically no corrosion—quite a contrast to the picture the oil refinery presents.

This paper describes the experience of The Texas Company as regards the service and life of various types of condenser tubes in petroleum refining.

The early art of refining utilized huge submerged coils of thick-walled cast-iron pipe with distillates passing through the coils and cooling water surrounding the coils. The life of the coils was possibly 8 to 10 yr. When leaks occurred, repairs were made and the coil remained in service.

Approximately ten years ago, modern methods of petroleum refining were introduced with the use of pipe stills necessitating high thermal efficiencies. The submerged coil became, to a considerable extent, obsolete. Its large size and low thermal efficiency precluded its use in modern and compact stilling equipment. The shell-and-tube type of heat exchanger began to be used in large numbers, utilizing many tubes having a thin wall ($^1/_{16}$ in.). A popular size of tube is shown in Fig. 1. The exchangers vary in size from units containing a few tubes to huge condensers containing nearly 2000 tubes. The refiner very early experienced costly failures, but the operating value of this type of heat exchange unit is so great that, in designing new equipment, numerous exchangers of this type are specified even though costly replacements must be made.

The oil refinery uses tubes under the following conditions: The liquids or gases being condensed or cooled are usually corrosive; The cooling water in the Gulf Coast district and elsewhere is also corrosive; and high temperatures are customary, accompanied by relatively high metal temperatures. The tubes are small ($^3/_4$ in. in diameter) and closely spaced; they become dirty on the outside from the products of corrosion to such an extent that unless cleaned periodically it is often impossible to clean them at all; they partly plug from the water side due to water scale. The refiner needs a tube which will withstand unusual conditions due to circumstances beyond his control. In water-cooled exchangers, some few leaks may be tolerated with a consequent money loss due to wasted distillate or with distillate contaminated with water which must later be removed. In the case of oil-to-oil exchangers, no leaks are tolerated, since this would result in one stream or the other being thrown "off-test."

[1] Metallurgist, Refining Dept., The Texas Company, Port Arthur, Tex.

In the Port Arthur refinery of The Texas Company, records show 220,000 tubes in shell-and-tube type of heat-exchange equipment. Approximately 20,000 of these tubes were installed new during the year 1938, and the other 200,000 tubes were in service prior to that time. Of the 200,000 tubes, 56,000 were replaced during the year 1938—a yearly replacement of 28 per cent. The tubes used are mostly non-ferrous (brass) and are usually $^3/_4$ in. in diameter, 16-gage wall and of various lengths, commonly 10 to 12 ft.

The ordinary materials to be cooled are the distillation products of petroleum ranging from naphtha to gas oil and including lubricating distillates. They are corrosive because they are high in temperature and contain corrosive salts such as magnesium chloride, corrosive sulfides, and organic and mineral acids. It is the refiner's duty to neutralize the acids by using ammonia or some other neutralizing agent; however, an excess of ammonia not only is costly but also attacks brass. Considerable skill is required in using the proper amount of neutralizing agent.

Water, used for cooling purposes at Port Arthur, is often brackish and hot (90 F.). Recently, excellent cooling water was used in a closed system, but this brings a problem of its own because this water is air cooled in atmospheric or forced-draft cooling towers and the water becomes saturated with air and therefore corrosive because of the oxygen content.

A typical analysis of cooling water is given in Table I.

TABLE I.—ANALYSIS OF CONDENSER WATER, P.P.M.

Ca	94	R_2O_3	26
Mg	227	pH	68
CO_3	7	Organic and volatile matter	1084
HCO_3	24	Residue on evaporation	6649
Cl_2	3690	Suspender matter	19
SO_4	509	$CaCO_3$	39
CO_2	0	NaCl	5378[a]
OH	0	$MgSO_4$	399
SiO_2	16	$CaSO_4$	268
		$MgCl_2$	576

[a] This varies from 110–11,400.

The quality of the water varies from month to month, depending upon the rainfall. With heavy precipitation, the water improves. The change in the quality of the water possibly explains the difference in the life of any particular alloy when used repeatedly in the same location.

Tubes made of any one of the various brasses may fail due to any one or a combination of causes, most of which are well known, but the frequency with which they fail in refinery service is not generally appreciated. Figure 2 illustrates failure due to dezincification. The mechanism of this failure is reported in the current literature. Briefly, a brass will go into solution and then redeposit copper as a plug. The photograph shows many plugs of redeposited copper. Observe the large plug in the specimen at the left. The copper plugs are readily corroded by sulfides in the oil, and in a short time holes appear in the tube until a bundle of tubes contains many holes with resultant excessive leakage. It is customary to inspect tubes regularly, plug the leaking ones, and eventually replace the entire tube bundle when the number of plugged tubes has

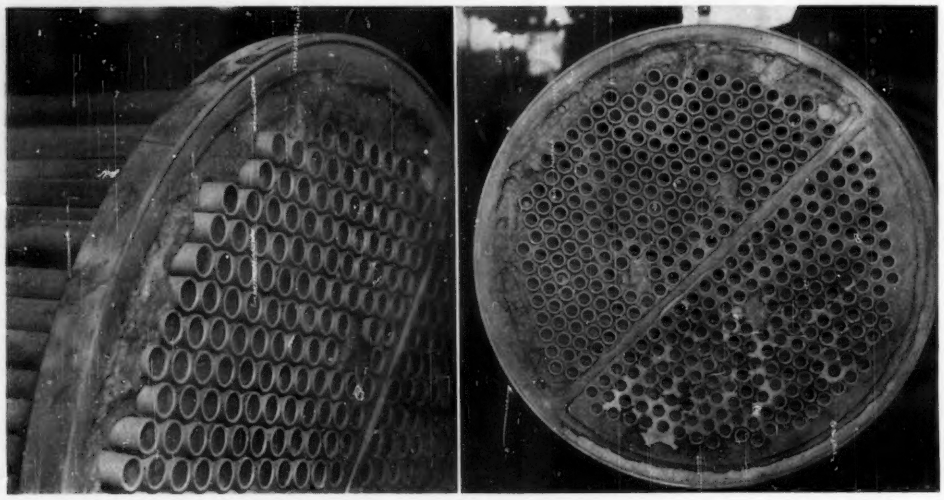


Fig. 1.—Metallized Steel Tube Sheet.

reached a certain predetermined percentage of the total number of tubes in the bundle. This type of failure is experienced in marine and other services only after a period of years. In refinery service, failure sometimes occurs after a few months. The quality of the water used, the temperatures encountered, and the kind of oil being processed are factors entering into this type of corrosion. The common brasses, such as Muntz metal and admiralty metal are the chief offenders. To eliminate dezincification, it is customary to use red brass and this metal has recently found favor to an increasing degree. Red brass fails from water pitting, but not from dezincification to the same extent as does admiralty, and its high copper content (85 per cent) makes it readily corroded by sulfides in the distillate. An attempt has been made to use copper tubes, but the rapid rate of corrosion from oils precludes its extensive use except where the oil is noncorrosive, that is, finished oil. Manufacturers have approached this problem by alteration of the standard brasses and particularly by the recent additions of small quantities of elements which are expected to inhibit corrosion due to dezincification.

A review of the large number of modified brasses and other non-ferrous metals presented for use for tubes reveals an impressive amount of research work which has been done, and the seriousness of this problem which has not as yet been economically solved. With respect to helpful added ingredients, mention may be made of arsenic, antimony, and more recently phosphorus, all of which under laboratory tests and in some cases under field tests have shown promise. The author has noted an improvement with respect to dezincification when arsenic was added, but because of cracking of tubes containing arsenic the use of this alloy tube has been discontinued. It is impossible to state whether the cracking of tubes occurred because of the arsenic. Many tubes did not crack although arsenic was present. The value of antimony and phosphorus has not as yet been determined by the author.

When the copper content of brass is increased, and with certain tubes other than brass, freedom from dezincification is experienced but water pitting occurs. Specimens of these alloys which failed from water pitting have been examined by prominent laboratories but no satisfactory answer has been given as to the cause. It is not uncommon to have a red brass bundle fail in a certain location in a few months even though the preceding bundle of red brass lasted almost two years and the subsequent bundle of red brass also lasted two years. Explanations for this difference in service would of course stress changes in operating such as quality of water or quality of oil which may or may not be the real cause.

Tubes fail from oil corrosion caused by distillate on the outside of the tube. Generally the tubes operating under the coolest conditions are the ones least corroded, and many tube bundles in such service last for years. Locations where corrosion is most rapid are those where vapors

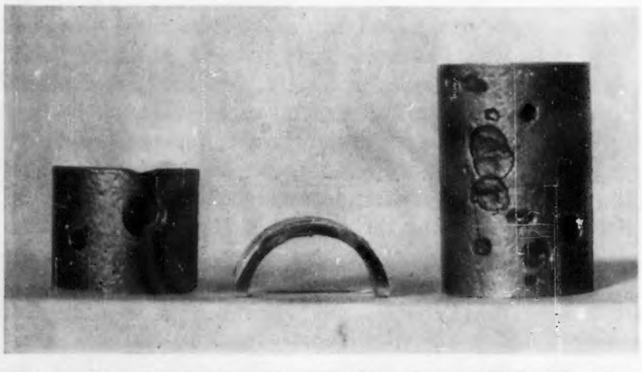
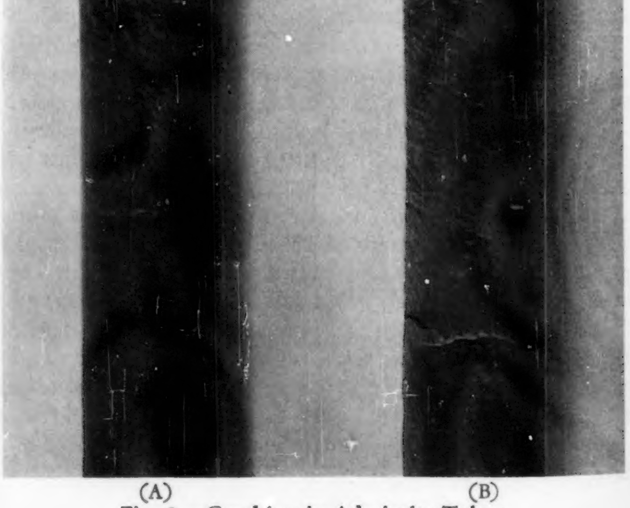


Fig. 2.—Sample of Admiralty Metal Exchanger Tube Showing Type of Failure Known as "Dezincification."



(A) (B)

Fig. 3.—Cracking in Admiralty Tubes.

TABLE II.—RAPIDLY CORRODED TUBE BUNDLES.

Bundle No.	Tube Material	Life, months	Number of Tubes	Number of Failures	Material Handled			
					Shell	Temperature, deg. Fahr.	Tubes	Temperature, deg. Fahr.
A	Admiralty	3	156	30	Kerosine	330	Water	85
651	Admiralty	8	490	100	Finished oil	300	Water	85
662	Admiralty	8	300	25	Solvent	235	Water	85
591	Admiralty	12	624	50	Naphtha	400	Water	100
125	Admiralty	6	282	72	Naphtha	380	Water	85
146	Admiralty	9	387	75	Naphtha	360	Water	100
190	Admiralty	10	267	20	Gas oil	600	Water	85
1177	Red brass	1	1484	4	Naphtha	275	Water	85
983	Red brass	1	1484	2	Naphtha	275	Water	85
1155	Red brass	6	156	20	Gas oil	375	Water	85
407	Red brass	$1^1/_2$	976	1	Gas oil	180	Water	85

Failure in all the cases listed in Table II was pitting on the water side of the tubes.
Tubes of same alloy from same manufacturer have given 18 to 24 months service in practically all above places.

TABLE III.—COMPOSITION OF ALLOYS.

Tube Material	Copper, per cent	Zinc, per cent	Tin, per cent	Nickel, per cent	Aluminum, per cent	Arsenic, per cent
1. Admiralty metal	70	29	1	..	..	..
2. Red brass	85	15	..	..	..	..
3. Copper-lined admiralty	70	21	1		With copper liner	
4. Copper-nickel (80–20)	80	..	..	20	..	..
5. Copper-nickel-tin	70	..	1	29	..	..
6. Copper	99+	..	..	..	..	..
7. Copper-nickel-aluminum	91.5	..	..	2.65	5	..
8. Copper-nickel-zinc	65	5	..	30	..	..
9. Arsenic-admiralty	70	29	1	..	..	Trace
10. Red brass plus tin	85	14	1	..	..	..
11. Copper-nickel (70–30)	70	..	..	30	..	..
12. Monel	25 to 35	..	..	60 to 70	..	..
13. Copper-lined Muntz metal	60	40	..		With copper liner	
14. Copper-lined steel			Carbon steel with copper liner			
15. Aluminum brass No. 1	76	22	..	..	2	..
16. Aluminum brass No. 2	76	22	..	..	2	..
17. Aluminum brass No. 3	76	22	..	..	2	..

TABLE IV.—COMPARATIVE COST AND LIFE IN OIL-TO-WATER SERVICE.

Alloys	Cost	Life	Ratio of Life to Cost	Cause of Failure
Admiralty	1	1	1	Dezincification
Red brass	1	1.5 to 3	1.5 to 3	Water pitting and oil corrosion
Copper-lined admiralty	1.5	1.5 to 3	1 to 2	Water pitting
Copper-nickel (80–20)	1.67	1 to 3	0.5 to 1.5	Water pitting and oil corrosion
Copper-nickel-tin	2.2	2 to 3	0.9 to 1.4	Water pitting and oil corrosion
Copper	0.93	..	..	None after 20 months
Copper-nickel-aluminum	1.9	..	..	No failures, but show oil corrosion after 52 months
Copper-nickel-zinc	2.16	3 plus	1.39[a]	None after 57 months
Arsenic-admiralty	1.3	0.76[a]	0.58[a]	Oil corrosion and cracking
Red brass plus 1 per cent tin	1.5	..	..	Not installed
Copper-nickel (70–30)	2	..	..	None after $15^1/_2$ months
Aluminum brass No. 1	1.5	1.5 to 3	1 to 2	Unknown. Bundle not removed to date
Aluminum brass No. 2	1.4	..	..	None after 15 months
Aluminum brass No. 3	1.6	..	..	None after 12 months
Monel	2.5	..	..	None after 3 months
Copper-lined Muntz metal	1.5	..	..	None after 1 month
Copper-lined steel	2	..	..	None after 15 months

[a]Based on one installation only.

are condensed to a liquid. In duplicate stilling units, certain bundles in each unit fail rapidly and certain tube bundles of both units have long life.

From the oil side, acid corrosion and sulfide corrosion are the chief offenders. Acid corrosion is identified by the etched appearance of the metal. Sulfide corrosion is identified by a black scale which, upon analysis, proves to be copper sulfide. Many bundles of tubes are green in color, indicating acid corrosion, and the characteristic deep blue of ammonium copper salts has been found when excess ammonia was applied to the oil stream. Failure of many tubes is caused by erosion. The velocity of the oil exerts an action on tubes similar to sand blasting or cavitation.

Another type of failure of interest is illustrated in Fig. 3. In recent years, cracking has become more prevalent in admiralty tubes. Early in the use of brass tubes, cracked tubes were rare—in fact almost never encountered. Now, cracked tubes are common, and there is no explanation as to why tubes crack in the same location where previously cracks were never experienced even after years of service. Metallurgical tests by brass companies revealed that the metal in the tubes shown in Fig. 3 was everything it should have been; analysis, heat treatment, grain size, and results of other tests made were correct. A very good example of the severity of water corrosion is shown in Fig. 1. The tube sheet shown was protected by metal spray. It has been quite customary to use steel tube sheets with brass tubes. Steel is cheap; brass tube sheets are expensive. When brass tubes are rolled into brass tube sheets, the holes in the tube sheet are so distorted that the tube sheets must be discarded after about two sets of tubes have been used. The cost of discarding brass tube sheets, 1.5 in. thick, forbade the use of brass. Possibly brass-clad steel would be satisfactory—steel to stand many sets of tubes without distortion, and brass for corrosion protection. Clad sheets have been used, but the development of clad sheet has not been sufficiently extensive for

the price to be favorable for common use, nor has the service been particularly satisfactory. In the photograph shown, the tubes were flush with the sheet when installed. The severity of the corrosion can be plainly seen. Many tube bundles have a life of two or three years, although as stated previously, 28 per cent of the tubes in service failed during the year 1938. As a matter of interest, Table II lists the history of a few rapidly corroded tube bundles. Many other examples could be cited.

Of the many alloys for tubes on the market, The Texas Company has tested most of them. Some had no value, some showed considerable promise. Table III shows a list of alloys considered of interest and on which tests are in progress.

Table IV shows relative costs and relative life. Many tests are not complete as it takes at least two years to gain an idea as to the merits of various alloys.

An appraisal of these tables reveals the following: The alloy listed as No. 11 (70-30 brass) has made an excellent showing to date with no failures. Being twice as costly as admiralty metal, it must give twice the life, and indications to date are that in some locations this will be realized. The dual tubes, copper-lined admiralty metal and copper-lined steel, appear to be satisfactory. Copper lining resists bad water and the steel or admiralty metal resists, in many cases, corrosive oils at least fairly well. It would seem that copper-lined Muntz metal will have promise; Muntz metal being higher in zinc than admiralty metal should resist corrosive oils better, the copper lining resisting the dezincification. In some cases, copper fails from pitting; therefore, it seems that steel or Muntz metal lined with 70 per cent copper, 30 per cent nickel, or with nickel should have merit, but here again price must be considered.

The monel tubes listed are costly and are being tested in cooperation with the International Nickel Co. who are sharing the expense of material. Copper tubes are being used for finished lubrication oils where the cooling water is corrosive, the idea being to obtain freedom from dezincification; their use is limited.

Of interest are the aluminum brasses. Tubes of the composition indicated have shown no failures after service for more than a year.

An interesting experience with the 70 per cent copper, 30 per cent nickel alloy is as follows: In a large pipe still unit it was very early learned that a certain heat exchanger (oil to oil) containing admiralty tubes had a life for the tubes somewhere between six months and a year. This exchanger contained 1484 tubes, $^3/_4$ in. in diameter and 5 ft. 6 in. long. Removal of this exchanger bundle, which weighs perhaps 8000 lb., necessitates lowering it from a height of approximately 70 ft. Because of corrosion, it became standard practice to remove this bundle at the end of six months regardless of whether or not it was leaking and then use it as a water-to-oil cooler in a similar and same size shell if a change in this water-cooled exchanger was necessary. When used as an oil-to-oil exchanger, leaks could not be tolerated because they would cause the oil stream to go off color and then the unit would have to be shut down. Shutting down and starting up a pipe still having 12,000 barrels per day capacity is serious, not only because of the work entailed but also because of loss of production while the unit is out of operation.

The 70-30 alloy was tested for corrosion by using strips of metal weighed before and after exposure to the liquids in question. Results were satisfactory and a tube bundle of this material was installed. At the end of a year there were no leaks; the tubes showed little corrosion and appeared to have ample thickness when struck with a hammer. The bundle was returned to service. It is expected to last six months more without leaks, at which time it will again be inspected and if satisfactory again returned to service. It is predicted that in this location, 70-30 alloy will last at least eighteen months, possibly two years, compared to six months for admiralty metal. When the cost of retubing such a huge exchanger is considered, results to date are indeed gratifying.

The question may be asked, "why not use this alloy more generally?" The alloy is costly, and because it is satisfactory in one location is no assurance that it will be so in all others. Gradually, however, other bundles where short life is experienced will be equipped with these tubes. It is a cut-and-try proposition. The author understands that this alloy has been found, by refiners other than The Texas Company, to be economical in spite of the high first cost.

The stainless steels have been used for exchanger and condenser tubes with poor success. They cracked when subjected to stress, they pitted when used with hot brackish water, and they were costly.

While it is true that much has been learned in the art of manufacture of these steels, and early tube failures cannot be taken as a criterion of what the later and more improved alloy will do, it is believed that stainless steel tubes are not generally used.

Until recently, the problem of prolonging the life of heat exchanger tubes in oil refinery work has been largely one of selection of the alloy and a demand upon the maker of the tube to supply a tube which will withstand the abuse encountered in service. The non-ferrous metallurgist has been the one to whom the problem has been assigned.

Recently we learned of other possible methods to secure long life aside from the search for the proper metals. The Texas Company has initiated three test procedures which are briefly described below. Because this investigation is recent and still in progress, no conclusions can be drawn, nor can any results of tests be given. The purpose of presenting these experiments is to stimulate similar research by others.

SPECIAL TREATMENT OF COOLING WATER

A great percentage of the exchanger tube failures could be eliminated if the cooling water could be treated so as to inhibit the effects of the oxygen in the water or to remove the oxygen completely. This is an old and established fact but its application to oil refinery work has, heretofore, been found to be uneconomical because of the tremendous quantity of water requiring treatment. The comparatively recent use of closed cooling water systems, involving forced draft or atmospheric cooling towers for individual refining units, has aggravated oxygen corrosion but, at the same time, has made possible the economical treatment of all of the cooling water on a particular unit.

There are many chemicals on the market that can be used to inhibit the effect of oxygen in water. The chemical is added to the water at the cooling tower sump.

The amount required to give economical protection must be determined by experiment. Figure 4 shows the effect, on steel water lines, of using a chromate inhibitor.

Another expedient, now under test, is a mechanical deaerator which is designed to remove the air from 1000 gal. per min. of cold water. The use of deaerators in steam power plants is an old practice but the deaeration of large quantities of cold water is new. The deaerator consists of a cylindrical steel vessel about 5 ft. in diameter and 20 ft. high. The water flows downward through the tower over a series of trays or baffles. A high vacuum is maintained in the vessel, and the dissolved gases are thereby removed. It is proposed to reduce the final oxygen content of the water to zero by means of a light chemical treatment.

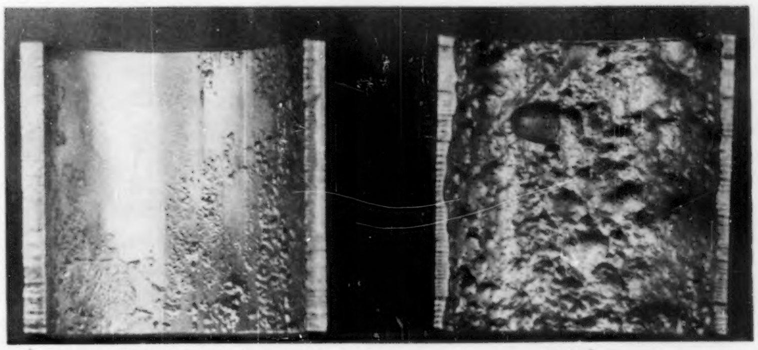
This piece of equipment has not been in service long enough to permit of drawing definite conclusions as to its effectiveness or economy of operation.

ELECTROLYTIC CORROSION PREVENTION

Any electrolytic corrosion prevention scheme is based on the fact that the metal to be protected (brass tubes in this case) must be maintained at a negative potential with respect to the anode which is in contact with the water but is insulated from the metal parts of the equipment. A direct current, usually supplied by a motor generator set, is caused to flow from the anode through the water to the tubes and other metal parts of the heat exchange unit and thence back to the generator. The tubes are protected at the expense of the anode which "plates-out." These anodes are usually made of plain carbon steel and can be renewed, if necessary, at regular down periods of the unit.

The success of this system depends largely upon the knowledge and practical skill of the designer and of the operator. Installation in oil refinery shell-and-tube heat exchange units is more complicated and more expensive than an installation for the same area in a large steam power plant condenser. This is due to the relatively small areas in the individual refinery units, their location, and the fact that the electrical equipment must be explosion proof.

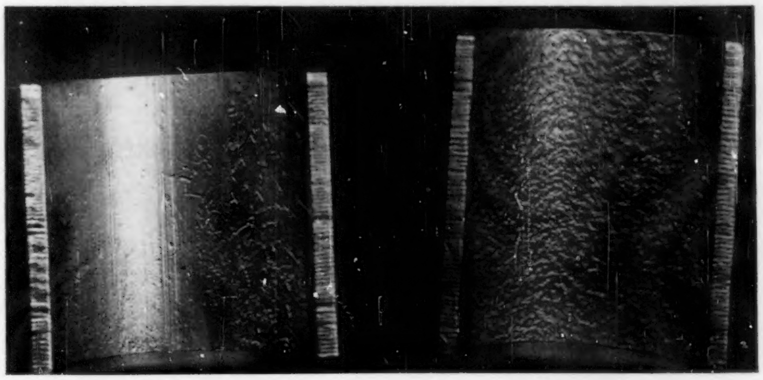
The results, thus far, of a small scale test of one electrolytic corrosion prevention system indicate that the brass tubes show less corrosion than do other tubes under identical operating conditions but without the protection of such an electrical system. The test has not yet progressed to the point where it would be desirable to publish conclusions or recommendations. This is a specialized subject and will be handled in more detail at a later date.



114 days service
With chromate

266 days
No chromate

No. 6 Condenser



52 days service
With chromate

62 days service
Some chromate

No. 18 Cooler

Fig. 4.—Effect on Steel Water Lines of Using a Chromate Inhibitor.

DISCUSSION

MR. H. H. MOORE.[1]—I should like to ask the author how many initially defective tubes go into the condenser?

MR. E. S. DIXON.[2]—I have no knowledge.

MR. MOORE.—I happen to have some experience in the matter of marine condensers; there are about 3 per cent of tubes initially defective when they go into service.

I should also like to ask whether Mr. Dixon has found any concentration of failures in a particular part of the condenser.

MR. DIXON.—Any concentration of failures generally occurs where the hot gases enter.

MR. MOORE.—You do not find a concentration of failures in any particular part which would indicate potential difference as the cause of the failures?

Experience with marine condensers shows there will be a concentration of failures in some particular part, where a total of 90 to 95 per cent of all tubes failing will be in this particular locality. I am wondering whether Mr. Dixon has had any experience with what is known as a "hydrodynamic shock test" to assist in the discovery of poor tubes that are near the end of their useful life. The Condenser Service and Engineering Co. of Hoboken, N. J., has been advertising such a test during the past several years and I

[1] Mechanical Engineer, Naval Ordnance Laboratory, Navy Yard, Washington, D. C.

[2] Metallurgist, Refining Dept., The Texas Company, Port Arthur, Tex.

understand it is highly successful in the marine field; it might be worthy of consideration by the oil refineries. My own thought is that it might be well to apply this hydrodynamic shock test to new tubes in lieu of the hydrostatic test which is now being applied. The company that I have mentioned applies this hydrodynamic shock test to all new tubes which they put in service; that is how this 3 per cent of new tube failures previously mentioned has been learned. They likewise apply it to condensers which have been in service and are undergoing overhaul and in that way they eliminate tubes which are near the end of their useful life and save the tubes of the condenser which are still good for a great deal more service. It affords a great saving in tubes and increases the length of interval between overhauls.

Mr. Dixon.—We have never found a concentration of failures which indicated to us potential difference as the cause of failure. Nor have we completed sufficient study of potential differences to answer this question.

With respect to the hydrodynamic shock testing equipment, we have been informed there is such equipment in existence but have never used it. Our information is to the effect that the price demanded for this instrument, plus a royalty, is such that our interest ceased.

Correlated Abstract of the Literature for 1938 on the X-ray Testing of Materials

Contributed by Subcommittee IV on Correlated Abstracts of Committee E-7 on Radiographic Testing

Editor's Note.—This correlated abstract and list of references is one of the accomplishments of Committee E-7 on Radiographic Testing as mentioned in its 1939 annual report. W. P. Davey, Research Professor of Physics and Chemistry, School of Chemistry and Physics, The Pennsylvania State College, is chairman of the subcommittee directly responsible for the preparation of the abstract.

EQUIPMENT FOR RADIOGRAPHIC TESTING

Low voltage (4 to 18 kv.) X-ray tubes have been described (*1*)[1] for use in testing cloth, leather, and paper. High voltage (800 kv.) X-ray tubes which require constant pumping have been described (*2*), suitable for use on such metals as steel and brass. Two specialized mobile units have been designed (*3, 4*) one for use in the inspection of welds, and one for the inspection of special factory-made parts such as heating units for cookstoves. An automatic inspecting machine has been invented (*5*) which employs a scanning slit, an ionization chamber, and an amplifier.

Two new stereoscopic localizers have been described (*6, 7*).

A collodion film impregnated with ammonium metavanadate has been described (*8*) for use with chromium characteristic radiation.

The proper design of densitometers for X-ray photographic films has been discussed (*9*) and attempts have been made (*10*) to measure the absolute sensitivities of X-ray films. An attempt has been made (*11*) to determine the characteristics of intensifying screens by means of an aluminum staircase, protected by lead shields at the sides. An extensive study has been made (*12*) of metallic intensifying screens. It turns out that the intensification factor increases with tube voltage from 160 kv. to 200 kv. Elements of high atomic number make the best screens for short-wave-length work. It is recommended that the front screen should be between 0.010 and 0.015 cm. in thickness. The back screen should be quite thick to keep out back-scattered radiation. A geometrical study has been made (*13*) of the fogging action of secondary rays caused by primary X-rays going past the edge of a filter. Gamma-ray radiography is represented by two A.S.T.M. papers (*31, 32*), one of which shows how shorter source-to-film distances can be used, and the other of which discusses the use of intensifying screens with gamma rays.

EQUIPMENT FOR TESTING BY X-RAY DIFFRACTION METHODS

A small portable diffraction unit has been designed (*14*) for industrial use, by which three diffraction patterns can be taken simultaneously, using the powder, rotation, or back-reflection methods. Precision cameras have been designed for high temperature work (*15, 16, 17*). Two new focusing schemes have been described for use with the Seemann-Bohlin type of camera; one (*18*) uses an adaptation of the Soller type of slit, the other (*19*) uses a bent rock-salt crystal. The latter scheme is said to give a monochromatic beam of FeK alpha which is about thirty times as strong as that obtained from a plane rock-salt crystal.

A comparison has been made (*20*) of the mixed-powder and the substitution methods in the quantitative evaluation of X-ray reflections from crystalline powders, and a critical examination of standardizing technique has been made (*21*).

INVESTIGATIONS OF FATIGUE AND RESIDUAL STRAIN

Externally applied stresses are capable, under certain conditions of producing severe internal strains and distortions of crystallites (*22*). Relatively simple X-ray methods have previously been worked out for determining the resulting surface elastic strains. A further simplification is now proposed (*23*) by which one of the three strain components can be deduced from a single record. The magnitude and direction of the principal strains may therefore be obtained from three records. An extension of the method makes it applicable to hexagonal lattices.

[1] The italic numbers in parentheses refer to the reports and papers appearing in the list of references appended to this paper.

(Reference may here be made to a rather full theoretical and practical discussion of residual strain in different directions in a steel cylinder by Kurdjumov and others (*24*).)

PRECISION MEASUREMENT OF COEFFICIENT OF EXPANSION

Using a camera especially designed for use at high temperatures, diffraction patterns of silver were obtained (*17*) at various temperatures up to 943 C. From the lattice spacings so obtained, a formula was found which gives the expansion of silver from absolute zero to the melting point.

DETERMINATION OF PARTICLE SIZE

A new experimental method is described (*25*) by which one may determine the broadening of lines in a diffraction pattern caused by experimental conditions. This offers a basis for a correction of the experimental data before the particle size of the specimen is calculated.

CHEMICAL ANALYSIS BY X-RAY DIFFRACTION METHODS

A complete, new workable system of chemical analysis has been worked out for crystalline materials, using X-ray diffraction data (*26*). It consists of a simple system for classifying the diffraction data from known crystalline substances and a rapid method for comparing the diffraction pattern of an unknown specimen with the classified data. The unknown specimen is thus identified when and if an exact match is found. This is probably the outstanding article of the year in analytical chemistry.

PROTECTION AGAINST HARD X-RAYS

The absorption of concrete for hard X-rays depends, of course, upon the density of the concrete (*27*). A properly made concrete is said to have a ratio of concrete to equivalent lead of 80 : 1 for 150-kv. X-rays, and a ratio of 15 : 1 for 500-kv. X-rays (*28*). The lead equivalents of various samples of concretes containing portland cement, sand, crushed stone, and barytes, have been determined (*29*) for various voltages between 100 and 400 kv. by direct comparison with lead sheets, using an air ionization chamber. If thickness of concrete is plotted against equivalent thickness of lead, the curve is approximately parabolic. When the lead equivalents of a given thickness of concrete are plotted as ordinates against peak tube voltages, maxima are found at 100 kv., and minima at about 200 kv., after which the curve rises steeply. A method is indicated for extending the data up to 5000 kv. The tabulated data are shown in the adjoining table.

Experimental data at 1000 kv. (*30*) show that 6 in. of lead absorbs "most" of the radiation, and a combination of 12 in. of cement and 1/2 in. of lead is considered "safe" for an operator because of an assumption that the very penetrating rays coming through this combination are less harmful than softer rays.

BOOKS AND REVIEW ARTICLES

"Bibliography of Industrial Radiography."

By H. R. Isenburger, *Document 1139*, American Documentation Inst., 52 pp., photoprint form, $3.50 (1938).

Contains 776 references; covers the field chronologically up to July, 1938, with no other type of classification.

LEAD EQUIVALENTS OF VARIOUS MATERIALS

Material	Mean Density, g. per cu. cm.	Lead Equivalent, mm.	Corresponding Thickness of Materials, mm. — X-rays Excited at Peak Voltages of				Corresponding Thickness of Materials, mm.
			150 kv.	200 kv.	300 kv.	400 kv.	Radium Gamma Rays
Iron	7.9	1	11	12	12	11	2.5
		2	25	27	20	18	5
		3	37	40	28	23	7
		4	50	55	35	28	8.5
		6			48	38	12
		8			60	45	16
		10			75	55	19
		15				75	27
		20					35
		50					80
		100					150
Barium concrete or plaster:	3.2	1	10	14	14	13	5
2 parts coarse $BaSO_4$		2	21	30	27	24	10
2 parts fine $BaSO_4$		3	35	45	40	35	15
1 part cement		4	50	60	50	45	19
or		6			70	65	28
1 part coarse $BaSO_4$		8			90	80	36
1 part fine $BaSO_4$		10			120	100	45
1 part cement		15				140	65
		20					85
		50					200
		100					400
Barium concrete or plaster:	2.7	1	17	22	22	18	7
2 parts coarse $BaSO_4$		2	38	50	42	35	13
2 parts sand		3	65	75	60	50	18
1 part cement		4	90	100	75	60	24
or		6			105	85	34
1 part coarse $BaSO_4$		8			135	110	45
1 part sand		10			165	130	55
1 part cement		15				185	75
		20					95
		50					225
		100					450
Concrete:	2.2	1	85	80	60	50	8
2 parts ballast		2	160	150	95	75	16
2 parts sand		3	230	210	125	100	22
1 part cement		4	295	275	150	120	29
		6			210	150	40
		8			260	185	55
		10			300	220	65
		15				300	90
		20					120
		50					280
		100					550
Brick (Daneshill red)	1.9	1	110	100	85	80	11
		2	200	190	140	110	20
		3	280	270	170	140	28
		4	370	350	210	160	37
		6			280	210	50
		8			340	260	65
		10			400	300	80
		15				400	110
		20					150
Brick (Yellow stock)	1.6	1	130	130	100	90	15
		2	240	240	150	130	27
		3	340	340	200	160	39
		4		430	240	180	50
		6			320	240	70
		8			390	290	85
		10			460	340	105
		15				450	150
		20					200
Coke Breeze (Clinker concrete)	1.2	1	140	150	120	110	16
		2	250	270	190	160	30
		3	350	380	240	200	43
		4		490	290	230	55
		6			380	300	75
		8			460	350	95
		10			550	400	115
		15				510	165
		20					220

Discussion on "Non-Destructive Testing" held under the auspices of The Institution of Electrical Engineers, (British), November 25, 1938. This discussion included the following papers:

"Radiography; An Aspect of Non-Destructive Testing," by V. E. Pullin. A quantitative discussion of radiographic technique. Includes a short discussion of crystal analysis technique.

"Industrial Radiography on the Continent of Europe," by J. E. de Graaf. A description of apparatus, and of the use of results for the acceptance test.

"Non-Destructive Testing in the United States," by H. H. Lester, R. L. Sanford, and N. L. Mochel. The first part of this review deals with radiographic methods in the foundry and weld-shop, and with a

résumé of the activities of various industrial radiographic committees. (This paper also appeared in two parts in the A.S.T.M. BULLETIN, No. 95, December, 1938, p. 5; No. 96, January, 1939, p. 13.)

"Welding of Steel Structure."

Report of Department of Scientific and Industrial Research, (Great Britain) (1938).

A 326-page report followed by four appendices dealing with: a statistical examination of the strength of welded joints, an investigation of non-destructive methods of testing welds, research on the fatigue-resistance of welded joints, and a survey of the literature.

"Examination of the Macro-Structure of Raw Materials and Products with the Help of X-rays."

By J. E. deGraaf, *Philips Technical Review*, October, 1937—June, 1938. A series of five short articles giving in some detail the testing of materials by X-rays, using what the author calls "the absorption method."

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(*4*) Anonymous, "X-ray Investigation of Materials," *Fachberichte*, Vol. 10, p. 137 (1938).

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Publications on Lime and Petroleum Products

Two INTERESTING publications have recently come off press, namely, the Symposium on Lime and the booklet entitled "Evaluation of Petroleum Products." Members who have ordered these publications should by this time have received them.

The Symposium on Lime covering some 125 pages includes eleven technical papers presented at the 1939 Spring Meeting in Columbus, Ohio, and an introduction to the symposium by Prof. J. R. Withrow who was chairman of the committee responsible for developing it. The symposium covers a number of fundamental aspects, certain research angles, and deals especially with problems in the practical application of lime in various forms.

The men who prepared the papers are outstanding authorities and the publications should be of widespread interest to those concerned with this material. Copies are available to members at 75 cents, heavy paper cover; \$1.00, cloth cover. The list prices are \$1.25 and \$1.50.

The publication, "Evaluation of Petroleum Products" (referred to in the List of Publications and Members' Order Blank, mailed last September, as "Summary of Work in the Field of Petroleum Products"), is made up of six papers reviewing the present status of testing petroleum products and lubricants and suggesting some further needs in this field. These were prepared upon the invitation of Sectional Committee Z11 on Petroleum Products and Lubricants and published in this booklet to make them available to all who might find them of interest and value. Covering some 54 pages, the papers, by prominent technical leaders, cover lubricating oils, petroleum lubricating greases, gasoline, Diesel fuels, fuel oils (other than Diesel), and the status of research on fuels and lubricating oils for spark-ignition aircraft engines.

Copies can be obtained by members at 50 cents each, the list price to nonmembers being 75 cents.

Measurement of Average Particle Size by Sedimentation and Other Physical Means

By Pierce M. Travis[1]

SYNOPSIS

The measurement of particle size below the No. 325 screen size of pigments, mineral aggregates, fillers, etc., is assuming greater importance in control work in meeting specifications. Similarly, the interpretations of results in research work show a need for a method which will give average particle sizes below the range of the mechanical screen and in the zone above the colloidal sizes.

A sedimentation apparatus by which this can be accomplished with results comparable with those obtained in microscopic methods is described in this paper.

THE DETERMINATION of particle size of subsieve size material has assumed increased importance in control work and in research problems. For example, in the case of mineral pigments it is important that they be ground to a particle size below 44 microns (No. 325 sieve) so that the coarse particles will not mar the finished paint or lacquer film. The same applies to paper sizing materials and to ceramics where it is desirable that the particle sizes be graded and conform to specifications so as to get a uniform product when the particles are fused together. In fact, the same applies generally to all coatings and finishes in developing a smooth product. For example, in the time of setting of special portland cements the particle size is a factor where quick setting is desired.

Over the past 20 yr. a great amount of research work has been done in the study of particle size distribution, much having been published in the various scientific journals. Yet one still finds a large number of plants where, aside from an occasional microscopic examination, the particle size distribution is frequently judged only by the appearance of the finished product.

There are, of course, various methods of determining particle size in a relative way[2] such as by turbidity, using photoelectric cells, weighing of sediments, microscopy, etc. There still remained, however, a need for a simple, rapid method.

In studying existing methods, it has been the author's experience:

1. In turbidity measurements very satisfactory results could not be obtained with low-price apparatus. In duplication of tests the errors in some cases were quite large and could not always be depended upon even though a photoelectric cell was used.

2. Settling and weighing methods required too much preparation and were too time-consuming.

3. The microscopic methods did not give a fair average unless considerable time was consumed in making numerous readings. For example, with about 1 mg. on a slide it is very difficult to get fair samplings. Also the measuring of average diameters is largely an approximation when making a few readings.

After investigating various methods, it was decided to use a sedimentation tube which has the advantage that about 2500 times as much sample can be used and a fairer cross-section thus secured of the average true conditions. It was found that results could be duplicated quite readily within the limits of the apparatus when they were run under the same conditions. With some improvements the apparatus was suitable for measuring particle sizes from 44 microns down to about 4 microns in diameter. While below this size it is not practical to try to estimate percentages by sedimentation, the total percentage of these superfines can be recorded on the final settling.

Fig. 1.—Apparatus for Measurement of Particle Size.

APPARATUS

The apparatus as developed is based on the rate of sedimentation according to particle size of the dispersed particles in a liquid, and applies to particles exceeding colloidal dimension and which settle under the force of gravity.[3] These particles are in a zone which for practical purposes covers from 44 microns to 4 microns in diameter, are very satisfactory for giving comparative results and control work so as to maintain a uniform product.

The apparatus (Fig. 1) consists of a glass tube of 15-mm. bore, long enough to give a height of fall of 110 cm. A mixing chamber 15 cm. in length for holding the sample is separated from the tube by a stopcock having an accurate bore, so as not to interfere with the settling of the materials. The glass tube is mounted on a suitable metal support. At the bottom of the tube is a flat-bottom sedimentation-measuring tube having a 7-mm. bore and a length of 150 mm. It is graduated in millimeters and is supported by an interchangeable ground-glass stopper. A micrometer eyepiece, mounted at the left of the sedi-

[1] Consulting Colloid Chemist; President, Travis Colloid Research Co., Inc., New York, N. Y.

[2] H. N. Holmes, "Laboratory Manual of Colloid Chemistry," Third Edition, John Wiley and Sons, New York, N. Y. (1934).

[3] F. E. Bartell, "Laboratory Manual of Colloid and Surface Chemistry," Edwards Brothers, Inc., Ann Arbor, Mich. (1936).

mentation-measuring tube, enables one to read sediment heights in fractions of a millimeter. To the right of the sedimentation-measuring tube is a small electric tapper which keeps the sediment column level. A light is also provided to facilitate reading. An electric stopclock to operate on 110-v., 60-cycle a.c. is housed in the wooden cabinet at the base of the equipment.

PROCEDURE IN TESTING

The sedimentation tube is filled to the height of the release stopcock at the bottom of the mixing chamber with a liquid medium through which the sample is to be settled and in which it is insoluble. This gives a total height of fall of 110 cm.

The sample is well quartered and a representative portion, weighing about $2^1/_2$ g., is mixed with a suitable wetting agent. The selection of this wetting agent is very important in order to lower the surface tension and increase penetration so that the particles are properly dispersed. Many wetting agents are available so that it is possible to select a suitable one for almost all substances.

Determinations can be made in distilled water for those substances which are not water-soluble. Where the material is soluble in water, water-white kerosine may be used. The material must be readily wetted by the liquid medium used; otherwise, some material must be added to increase the wetting power. For example, in materials that are not soluble in water, some of the sulfinated alcohols or some of the sulfinated compounds of the higher fatty acids may be added. Alcohol should be used in certain cases where the material does not flocculate therein.

After the sample has been well mixed or worked into a paste and properly thinned, it is put into a reservoir at the top of the tube.

The stopcock is opened and simultaneously the stopclock is started. The time required for the first particle to reach the bottom of the sedimentation tube is recorded as that for the largest particles present. Agglomeration of particles must be avoided; otherwise false readings will be obtained. Special deflocculating agents may be added to the liquid in the tube as well as in the mixing chamber, which agents must be standardized for different types of substances. At regular recorded intervals, the sediment is leveled off by means of the mechanical tapper and the height of the sediment in the small tube is read and recorded by means of the micrometer eyepiece. The tapper should be set so that a few taps will level the surface of the sediment.

For best results in making a determination, the density of the liquid and of the material when dispersed in the liquid should be determined. This, of course, is done by the usual laboratory method with a pycnometer, using a temperature of about 23 C. so as to have the product under conditions of room temperature.

The settling times are based on Stokes' law of sedimentation which assumes that the particles are perfect spheres. In spite of their irregularity, the particles settle at rates equivalent to the rates for spheres, that is, the calculations used are the radii of the equivalent spheres and are not necessarily the exact dimensions of the irregular particles.

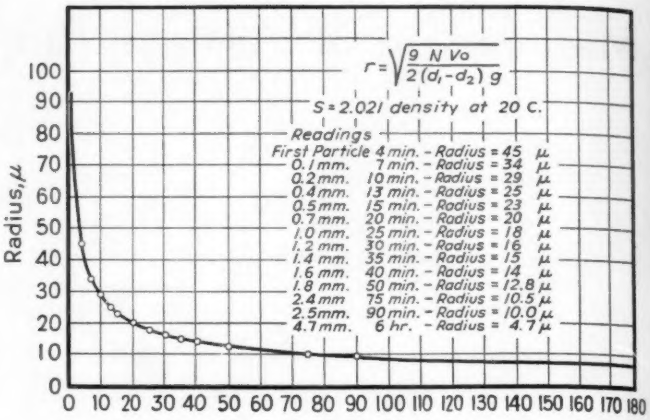

Fig. 2.—Particle Size Distribution Curve for Sulfur.

The rate of sedimentation, V_0, is equal to the height of fall, h, divided by the time in seconds, t.

After all readings have been made, the radius in particle size in microns can be determined by applying the following formula derived from the Stokes' equation:[4]

$$r = \sqrt{\frac{9NV_0}{2(d_1 - d_2)g}} \times 1000$$

where:

r = radius of particle in microns,
N = specific viscosity of medium as compared to water,
V_0 = rate of sedimentation, which is the height of fall in centimeters divided by the time in seconds,
d_1 = density of particle,
d_2 = density of medium, and
g = the acceleration due to gravity, which is 980 dynes in most places.

The radius of the particles is thus calculated and from this the diameter of the particles in microns is obtained. Where one substance is to be run frequently, a curve may be drawn by plotting radius against time, and the particle size read directly. This can be worked out to apply to various materials in the form of curves so that, knowing the time of settling, one can refer to the curve and read the radius of particles directly, thus saving much time in calculations after the curve is once established.

PERCENTAGE CALCULATIONS

From the sediment readings and the total sediment, the percentage of various particle sizes may be calculated.

The particle size distribution curves established by use of this apparatus, together with the laboratory data, are shown as typical runs on sulfur (Fig. 2), barium sulfate pigment (Fig. 3), and zinc dust (Fig. 4). It will be observed that the curves run quite regularly with regard to the calculations. This has been found to be generally true on practically every sample run as well as on duplication of work.

In order to show the region in which the equipment functions best, typical examples are shown: sulfur (Fig.

[4] Stokes, *Transactions*, Cambridge Philosophical Soc., Vol. 9, p. 8 (1851); also *Mathematical and Physical Papers*, Vol. 3, p. 1 (1901).

For modifications and limitations, see Cunningham, *Proceedings*, Royal Soc. (London), Vol. 83A, p. 357 (1910); also *Journal Am. Chemical Soc.*, Vol. 41, p. 319 (1919).

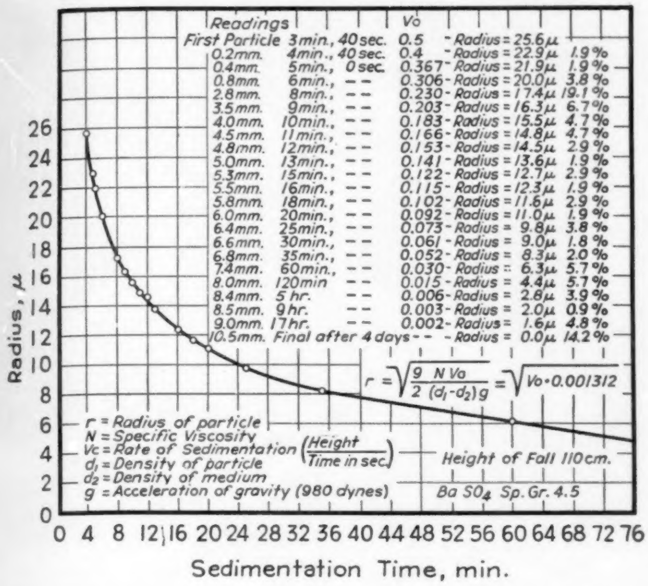

Fig. 3.—Particle Size Distribution Curve for Barium Sulfate Pigment.

2), barium sulfate (Fig. 3), and zinc dust (Fig. 4). It will be noted that the densities of these materials are 2.02, 4.5, and 7.14, respectively, at 20 C. which presents a wide variation in densities as typical examples. In the case of the barium sulfate (Fig. 3), a very wide particle size distribution is represented, ranging from 25.6 microns in radius for the largest particles down to 1.6 microns in radius and less for the smallest particles. The readings below 2 microns in radius are very close to the limitations of the equipment since settlings below this point are very slow, also because Brownian movement is first noticeable at about 3 microns in diameter which, of course, interferes with settling rate.

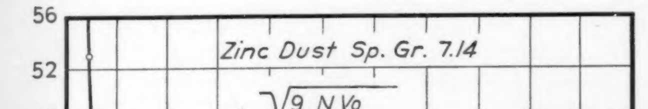

Fig. 4.—Particle Size Distribution Curve for Zinc Dust.

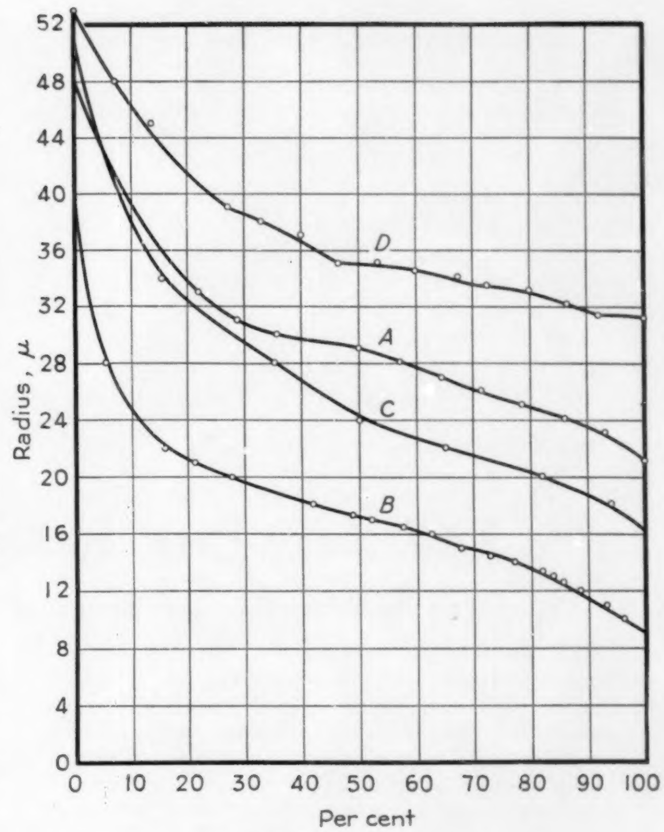

Fig. 5.—Zinc Dust Sample Comparisons.

TYPICAL ILLUSTRATION OF USE

A typical illustration of particle size distribution when plotted in percentage of a series of zinc tests is here presented. In this case the manufacturer was using zinc dust as a catalyst in bringing about a reaction. It was noted that one type of zinc dust gave a much better yield of product than the three others used. It was found that when these were tested by the method described they all gave a uniform curve, but of somewhat different maximum and minimum particle sizes, that is, some were coarser than others. However, when these curves are plotted showing the relation of radius to percentage, as in Fig. 5, it is seen quite clearly that the percentage of various sizes in three of the curves is not uniform. In one case there is a blending which is not in any uniform proportion (Fig. 5, broken curve *D*).

It will be noted that curves *C* and *B* (Fig. 5) show a much more uniform percentage distribution, representing zinc dust of very good yields. There was no doubt about curve *B* giving the better yield, for from Fig. 5 we find curve *B* uniform in percentage distribution with practically no breaks. We also note that it shows a finer particle size, hence greater contact surface and larger yield when used as a catalyst as well as better control of product. Particle size measurements in this case satisfied the manufacturer as to the reasons why he was getting such variations in his yield with different types of zinc dust.

MICROSCOPIC COMPARISONS OF SIZE BY VOLUME

In order to compare the readings with those obtained by microscopic measurements, a sample of carborundum dust was sent to an outside laboratory specializing in such readings.[5]

The results in Table I are as reported by the microscopic laboratory and those obtained on a portion of the same sample as determined on the sedimentation apparatus. It should be noted that the microscopic readings below 10 microns amount to 4.23 per cent.

The results secured by the sedimentation apparatus compare very favorably with actual measurements obtained by the microscope with the advantage of considerable saving of time, since in the case of microscopic readings a large number of measurements must be obtained to get a fair average of sample.

[5] C. P. Schillaber, Microscopic Laboratory, Long Island City, N. Y.

TABLE I.

Microscopic Readings (500 Measurements Calculated to Per Cent by Volume for Comparison)		Readings as Obtained by the Sedimentation Apparatus	
Diameter, microns	Per Cent by Volume	Diameter, microns	Per Cent by Volume
		Above 40	3.0 } 5.5
35 to 40	6.6	35 to 40	2.5 }
30 to 35	4.3	30 to 35	4.5
25 to 30	10.7	25 to 30	11.5
20 to 25	25.0	20 to 25	22.5
15 to 20	34.8	15 to 20	29.2
12 to 15	11.8	12 to 15	14.8
10 to 12	2.7	10 to 12	5.9
8 to 10	2.4	Below 10 by difference	6.1
6 to 8	1.6		
4 to 6	0.2		
Less than 4	0.03		

XXII. Long-Time Society Committee Members

Twenty-second in the Series of Notes on Long-Time Members

As a continuation of the series of articles in the ASTM BULLETIN comprising notes on the outstanding activities of long-time A.S.T.M. members, there are presented below outlines of the work of three additional members. In general, the men whose activities are described in this series have been affiliated with the Society for 25 years or more and have taken part in committee work for long periods of time. No definite sequence is being followed in these articles.

S. H. INGBERG, Chief, Fire Resistance Section, National Bureau of Standards, Washington, D. C., following his graduation from the University of Minnesota in 1909 was engaged in post-graduate work in theoretical and applied mechanics followed by a year of teaching engineering subjects. From 1912 to 1914 he was active in structural engineering work in the Chicago district with the Chicago, Milwaukee and St. Paul Railroad and the James Stewart Co. as structural designer. Since 1914, he has been on the staff of the National Bureau of Standards, first assigned to cooperative research on fire resistance and building constructions and since 1921 has been located in Washington in charge of the Bureau's fire resistance activities.

He assisted several years ago in the organization of the Federal Fire Council, an interdepartmental organization concerned with fire loss prevention in connection with Federal Government activities. This work is an important phase of his present activities.

A member of the Society since 1911, he has been active on several committees dealing primarily with materials and subjects of interest in the field of construction. At present he is chairman of two subcommittees of Committee C-5 on Fire Tests of Materials and Construction. He has been a member of this committee since 1921, which year also was the beginning of his membership on three other committees, namely, C-11 on Gypsum, and the former Committees C-3 on Brick and C-10 on Hollow Masonry Building Units, the latter two having been combined in Committee C-15 on Manufactured Masonry Units. For three years, 1923 to 1926, he was chairman of Committee C-10. Mr. Ingberg is also a member of Committee E-1 on Methods of Testing, representing Committee C-5, and is the Society's representative on the Standing Committee on Simplification of Varieties and Sizes of Hollow Tile of the National Bureau of Standards.

Mr. Ingberg has been the author of a large number of technical papers and reports, several of which have been published in the Society's *Proceedings*.

In addition to A.S.T.M., Mr. Ingberg is a member of the following: Building Official Conference of America, American Association for the Advancement of Science, Washington Philosophical Society, and the National Fire Protection Association.

A. M. JOHNSEN, Engineer of Tests and Chemist, The Pullman Co., Chicago, Ill., whose technical training was in the field of chemical and metallurgical engineering, graduated from Lewis Institute in Chicago. He has been with the Pullman Co. for over twenty-seven years. As chemist and engineer of tests, his duties cover principally the evaluation of engineering materials employed in the construction of railway cars and maintenance materials employed in the operation of cars and shops.

A member of the Society since 1913, he is affiliated with a number of technical committees including Committee D-1 on Paint, Varnish, Lacquer and Related Products and three of its subcommittees. When Committee D-17 on Naval Stores was organized in 1924, Mr. Johnsen became a member and has served since. He is also a member of Committee D-12 on Soaps and Other Detergents, having

S. H. Ingberg

A. M. Johnsen

D. K. French

been on this committee since its organization in 1936. He is also a member of the Chicago District Committee. In the Symposium on Paint and Paint Materials sponsored in 1935 by Committee D-1 he contributed a paper on "Protective and Decorative Coatings for Railway Passenger Car Equipment."

He has been active for many years in the Association of American Railroads and is at present serving as a member of the A.A.R. Wheel and Axle Research Committees.

D. K. FRENCH, Consulting Chemist, Dudley K. French and Associates, Inc., Chicago, Ill., following his technical education at the University of Chicago where he majored in chemistry, was chemist, Dearborn Chemical Co., 1907 to 1932, at which time he established a consulting engineering practice. His chief interests are in the field of industrial water concerning problems that develop and proper methods to apply in overcoming the difficulties.

A member of the Society since 1913, he has been interested and active in a number of the committees, including D-2 on Petroleum Products and Lubricants, to which he was elected when he became an A.S.T.M. member, serving until 1932.

As directing chemist for the Dearborn Chemical Co. which had an extensive oil testing laboratory, he worked actively in the field of flash and fire tests and was chairman of the D-2 subgroup that developed the first tentative standard requirements for determination of saponification number. He served on Committee C-7 on Lime for a number of years and has been a member of Committee D-19 on Water for Industrial Uses since its organization. He is a member of three D-19 subgroups, serving as secretary of two of them.

He has been active in various phases of work of the American Chemical Society since his membership in 1906. Mr. French has held every office in the Chicago section, an indication of his intense interest in this organization. One of his A.C.S. activities involves abstracting work for *Chemical Abstracts*.

In addition to the A.S.T.M. and A.C.S., he is a member of The American Society of Mechanical Engineers, American Water Works Assn., and Society of Chemical Industry. His office is located at 6025 W. Sixty-sixth Place, Chicago.

1939 *Proceedings* in One Volume

PROGRESS CAN be reported on the publication of the *Proceedings* of the 1939 Annual Meeting, work on which has been somewhat delayed because of the urgency in completing the Book of Standards. *Proceedings* this year are for the first time issued in one volume, including the technical papers with discussion which formerly comprised Part II, and the reports of standing committees, appended papers, etc., which previously formed Part I.

It is expected that distribution of this extensive publication, aggregating some 1350 pages, will begin about the middle of February.

Special mention of particular papers is difficult because each member's field of activity determines largely his interest in particular items. There are many papers, some quite extensive, on subjects in the field of both ferrous and non-ferrous metals. This applies also to cement, concrete, ceramics, and masonry materials. The Symposium on Shear Testing of Soils with eight extensive technical papers comprises some 130 pages, with discussion. A number of papers in the field of industrial waters are included and others cover road and paving materials, radiography, and general testing. This section of the *Proceedings* will comprise some 750 pages.

Reports from practically all of the standing committees are published—some are of outstanding interest including the report on original characteristics of wire and wire products involved in field exposure tests and results of one year's exposure, part of the report of Committee A-5 on Corrosion of Iron and Steel; the final report on galvanic and electrolytic corrosion with extensive tables, part of the report of Committee B-3 on Corrosion of Non-Ferrous Metals and Alloys; and industrial surveys of conditions surrounding refractory service in lime burning and in continuous plate glass and window glass furnaces.

Each committee report describes the changes in standards and other recommendations concerning its work. A number of reports also have technical papers or subcommittee reports appended giving information and data on research work which has been under way. This section of the *Proceedings* comprises some 550 pages.

A detailed table of contents is included as well as a subject and author's index, the latter two items comprising some 45 pages. A copy of this publication is furnished to each member. Extra copies can be purchased at the price of \$6.00, the list price to nonmembers being \$9.00 each.

Comments on Proposed Standards

ONE OF the basic principles underlying the development of A.S.T.M. standards is that *everyone* interested in a specification or test method shall have an opportunity to participate in its development—by expressing viewpoints in committees and before the Society, or presenting data relevant to the subject considered or in other ways.

During October and November, the tentative standards which were approved at the annual meeting or by Committee E-10 on Standards are edited and published. In order to stimulate comment and criticism these are brought to the attention of trade associations and other organizations interested, business journals, and, of course, their widespread use in the various phases of production and consumption tend to stimulate comment.

One purpose in issuing proposed standards in tentative form is to elicit constructive criticism and comment, of which the standing committees in charge take due cognizance before recommending adoption as a formal standard. In this connection each A.S.T.M. member can be of service by reviewing critically tentative standards in which he or his company is interested or by bringing them to the attention of other interested parties, to the end that a standard will finally be adopted which will represent a true consensus of industry, be practical, complete, and authoritative. Comments should be forwarded to A.S.T.M. Headquarters.

ASTM BULLETIN

No. 102 January, 1940

Meetings of Committees

Hearing and using the term "committee meeting" year after year might cause this expression to sound rather common-place. As a matter of fact, the contrary is the case because as one gets to know more about the Society's technical committees and attends more meetings and learns their significance, each one becomes of considerable interest. Here is the meeting ground—battleground, if you prefer—but still the important place where the consumer, the producer, and the general scientist come together to reconcile differences and have a meeting of the minds so that eventually A.S.T.M. can issue a needed specification or test or change one already published.

Here, too, authorities exchange technical information and experiences and very frequently a bit of advice gained in a meeting is of indispensable value technically.

Considering the number of meetings held by committees throughout the year—we do not have the time nor are we sufficiently statistically inclined right now to make an accurate figure—but with 150 meetings at the Spring Meetings and some 200 at the Annual Meeting and adding a very conservative figure of 150, there are at least 500 committee meetings in an average year. The correct figure is probably nearer 750.

On the basis of an average attendance of ten men at the average length of an hour—both assumptions low—it can easily be seen that at meetings alone from 5000 to 7500 "man-hours" are put on work involving research and standardization in materials.

We might develop a lot of other startling statistics, perhaps estimating the amount of money spent on Society work, a great deal of which goes on behind the scenes unheralded and unsung. Here again the significant thing is that the work proceeds with the cooperation of committee officers and committee members from year to year with accelerated progress in some fields, slower progress in others, but always going forward and resulting in accomplishments of inestimable value to industry.

New Bulletin Dress

While a number of changes incorporated in this issue of the Bulletin, primarily on matters of format, rather speak for themselves, some few comments thereon would seem to be in order.

Two typographic experts working independently reached practically the same conclusion concerning the general scheme of the cover design, namely, the practical impossibility of having a design that would be symbolic of phases of the Society's work as a whole, ranging as it does from steel to textiles, concrete to petroleum, cement, water, and many other materials, and further from an evaluation of materials to the establishment of purchase specifications. Thus a simple design was indicated.

Recent discussions in the Papers and Publications Committee and elsewhere on the question of a title for the publication led to the retention of the present title. A separate contents page is in line with the feeling that the publication is now of a character and size to merit one.

The policy with respect to material published will be continued which means the inclusion of technical papers and reports of general interest or informational character. The distinction between a Bulletin paper and a *Proceedings* paper is often rather fine, but the general criterion is that the latter is one where reference value is paramount, possibly the amount of data given is more extensive and the conclusions may have a finality not necessarily true with the Bulletin paper.

More and more members are finding it desirable to file their Bulletins. In this connection, attention should be called to one minor change in the trim size which should not present difficulties. This provides for a slightly greater depth so that the trim size will be $8^3/_4$ by $11^5/_8$ in. rather than $8^3/_4$ by $11^1/_2$ in., the former figure. The new size is recommended by the Industrial Advertisers Association.

Inside the covers members may note a slight difference in the style of type, but it is the same family, namely, Garamond which is now in monotype instead of linotype used for the past several years. Changes in heads are relatively minor with some restyling of material which is set in smaller type.

The advertising policy remains essentially the same, space being available to manufacturers and distributors of testing apparatus, scientific equipment, laboratory supplies, and related material of concern in production, testing, and investigation of materials. Beginning with the May issue an increase in rates becomes effective, this advice having been transmitted to the companies interested in Bulletin advertising. A schedule will be sent to anyone interested. There has been practically no change since advertising was established in 1926. While the increases do not represent fully the increased value of the Bulletin from the standpoint of size, distribution, and other factors, they are more nearly in line with the publication's intrinsic value.

Finally and perhaps most important, the Bulletin will continue to be a *members* publication, designed to be of as much service as possible to the members. Your comments on this publication are always welcomed. Each member is invited to submit papers and other material deemed appropriate for use. Pages are always available for discussion of subjects consistent with the purpose and work of A.S.T.M.

Last Call for Meeting Papers

At its meeting in Philadelphia late in February, Committee E-6 on Papers and Publications will give consideration to the papers which have been offered for presentation at the 1940 Annual Meeting to be held at Chalfonte-Haddon Hall, Atlantic City, June 24 to 28. A number of offers have already been received. All members and others who wish to present papers should send their offers to Society Headquarters not later than February 1—blanks to be used in transmitting the necessary information can be obtained from the Society office.

Sustaining Membership Growing Rapidly

Fourteen New Ones Since January 1

THE CLASS of Sustaining Membership at annual dues of $100 is appealing to an increasing number of our members as a suitable means of support of the Society to an extent commensurate with the value of A.S.T.M. activities and accomplishments to them. Established eight years ago, business and economic conditions were unfavorable for some years, and there were only twelve sustaining members at the close of 1938. Last year a total of seventeen was added, as announced currently in the BULLETIN. At this writing 14 more, as announced below, have become sustaining members effective with the new year, bringing the present total to 43.

A significant fact to be remembered is that the rapid increase in A.S.T.M. standardization work (75 per cent increase in the past decade), which has resulted in greatly increased administrative and publication expense, has come about primarily through the needs of industry for the development of specifications and tests for materials. This work for some years has been growing faster than can be supported by normal membership growth and Sustaining Membership affords the opportunity for industrial companies—which benefit more than individuals from the utilization of materials standards—to give that added measure of financial support that will provide for the necessary expansion of Society work.

It should be added that Sustaining Members receive *all* publications issued by the Society, which includes in addition to those received on a regular membership, copies of all compilations of standards, various symposiums, and reprints of reports and papers that are issued from time to time. Moreover an extra set of the Society's most valuable publication, the triennial Book of Standards in three Parts with all supplements in the intervening years, is supplied to each Sustaining Member.

We invite others of our members to give thoughtful consideration to this type of membership.

New Sustaining Members

FIRESTONE TIRE AND RUBBER CO., AKRON, O., J. J. ALLEN, CHIEF CHEMIST, FALL RIVER PLANT, FALL RIVER, MASS.

Members of the Society since 1916, the technical representatives have been particularly concerned with the work of Committees D-11 on Rubber Products and D-13 on Textile Materials, having been represented on these committees for the past fourteen years. Mr. Allen, who is a member of the A.S.T.M. Executive Committee, is chairman of the Subcommittee on Rubber for Vibration Absorption, serves on the Section on Indentation Hardness and was formerly a member of the Cleveland District Committee.

CLIMAX MOLYBDENUM CO., J. B. THORPE, VICE-PRESIDENT, NEW YORK CITY.

Since 1929, when this organization became a corporate member of the Society, it has been active in the work of Committee A-9 on Ferro-Alloys. Mr. Thorpe was originally a member of this group; Mr. C. M. Loeb, Jr., Vice-President, is the present representative and secretary of the committee. The company is represented on Committee E-3 on Chemical Analysis of Metals, and its technical representatives are active in the work of the Steel Committee in the field of forgings, castings, pipe, etc.

LOUISVILLE CEMENT CORP., H. D. BAYLOR, PRESIDENT, SPEED, IND.

Mr. Baylor has been active in the work of Committee C-1 on Cement since 1924 and is a member of Committee C-12 on Mortars for Unit Masonry. He is a member of the C-1 Advisory Committee and chairman of its Sponsoring Committee on Masonry Cement (Including Natural Cement). He is a vice-chairman of Committee C-12, a member of the Advisory Group, and serves on the subcommittee on Specifications for Mortar.

THE AJAX METAL CO., G. H. CLAMER, PRESIDENT AND GENERAL MANAGER, PHILADELPHIA, PA.

Mr. Clamer, who was president of the Society in 1919 and made an honorary member in 1938, has been active in the Society, particularly in the field of non-ferrous metals, for a great many years, his company having been affiliated with A.S.T.M. since 1902. Mr. Clamer is a member of the Committee B-2 Advisory Committee, chairman of Subcommittee III on White Metal Alloys, and heads the group on copper-base alloys for castings, of Committee B-5. His company is represented on Committee B-3 on Corrosion of Non-Ferrous Metals and Alloys.

BETHLEHEM STEEL CO., INC., E. F. KENNEY, METALLURGICAL ENGINEER, BETHLEHEM, PA.

This company has been affiliated with the Society since it was organized as a committee of the International Association in 1898 and a large number of its technical men are active in various phases of committee work, particularly in the field of steel. Mr. Kenney, former member of the Executive Committee (1925 to 1927), has himself been a member of the Society since 1904. He is the present vice-chairman of Committee A-1 on Steel and chairman of its Subcommittee I on Steel Rails and Accessories.

PUBLIC SERVICE ELECTRIC AND GAS CO., H. S. VASSAR, LABORATORY ENGINEER, IRVINGTON, N. J.

Mr. Vassar, president of the Society in 1935, has been particularly active in Committees D-9 on Electrical Insulating Materials and D-11 on Rubber Products and is at present chairman of its Subcommittee IV on Protection of Persons from Electric Shock. He has recently been appointed to Committee E-10 on Standards. He was chairman of Committee D-9 on Electrical Insulating Materials from 1926 to 1930, and secretary from 1922 to 1926. A number of the other engineers in this company follow closely various phases of A.S.T.M. work through committee affiliations in such fields as petroleum, water for industrial uses, corrosion of iron and steel, etc.

STANDARD OIL DEVELOPMENT CO., E. W. DEAN, DIRECTOR, STANDARD INSPECTION LABORATORY, NEW YORK CITY

Mr. Dean, whose company has been affiliated with A.S.T.M. since 1921, also has been a personal member of the Society for many years. He has been particularly active in the work of Committee D-2 on Petroleum Products and Lubricants and was guest of honor at the 1939 annual D-2 dinner. The company through its technical representatives is active in the work of the committees on steel, corrosion, rubber products, and other groups.

OWENS-ILLINOIS GLASS CO., U. E. BOWES, DIRECTOR OF RESEARCH, TOLEDO, OHIO

This company has been a member of the Society since 1935, and in addition to Mr. Bowes, who represents the company on Committees D-9 on Electrical Insulating Materials, C-14 on Glass and Glass Products, and D-20 on Plastics, other Owens-Illinois engineers follow various committee projects, including the activities of Committee C-8 on Refractories.

THE NEW JERSEY ZINC CO., E. H. BUNCE, GENERAL MANAGER, TECHNICAL DEPT., PALMERTON, PA.

Through representation on numerous standing committees, particularly in the field of non-ferrous metals and alloys and also in the fields of paints and related products, corrosion of iron and steel and rubber products and through numerous contributions to publications of the Society

this company has been very active in A.S.T.M. work. The company, a member since 1923, has cooperated closely in many of the Society's most extensive research programs.

American Steel Foundries, W. C. Hamilton, Research Director, Indiana Harbor, East Chicago, Ind.

This company has been actively interested in Society work for many years, particularly, of course, in the field of steel castings. Mr. Hamilton has been chairman of the Steel Committee's Subcommittee VIII on this subject for a number of years and is also a member of Committee E-7 on Radiographic Testing. Mr. R. D. Brizzolara, Chief Engineer, is also a member of the Steel Committee and has cooperated very closely recently in the work involving spring steel and steel springs.

The Youngstown Sheet and Tube Co., G. A. Reinhardt, Director of Metallurgy and Research, Youngstown, Ohio

While primarily concerned with the work of Committee A-1 on Steel, this company, members since 1907, has followed closely the work of other committees. Mr. A. C. Badger, Metallurgical Engineer, a personal member since 1914, represents his company on Committees A-1 and A-5 on Corrosion of Iron and Steel, other engineers serving on D-19 on Water for Industrial Uses, and E-2 on Spectrographic Analysis. Mr. Reinhardt was a member of the A.S.T.M. Executive Committee, 1930 to 1932.

E. I. du Pont de Nemours and Co., Inc., E. K. Bolton, Chemical Director, Wilmington, Del.

As would be expected this large company, with its many divisions covering diverse fields, is concerned with many phases of A.S.T.M. work. This has been true for many years involving the activities of such committees as D-1 on Paint, Varnish, Lacquer, and Related Products, D-11 on Rubber Products (Mr. O. M. Hayden of the company is present chairman of this committee), D-20 on Plastics, D-13 on Textile Materials (especially rayon), and a number of others. There are a large number of the company's technical executives and engineers who are members or representatives of company divisions taking an active part in A.S.T.M. work.

Union Carbide and Carbon Research Labs., Inc., J. R. Dawson, Metallurgist, Niagara Falls, N. Y.

This organization, members since 1920, is a unit of Union Carbide and Carbon Co. It is at present represented on six standing committees participating actively in numerous subcommittees. Mr. Dawson and J. H. Critchett, Vice-President of the Laboratories and of Electro Metallurgical Co., are on Committee A-1 on Steel and other technical men are on Committees A-10 on Iron-Chromium, Iron-Chromium-Nickel and Related Alloys, B-4 on Electrical-Heating, Electrical-Resistance and Electric-Furnace Alloys, E-2 on Spectrographic Analysis, E-3 on Chemical Analysis of Metals, and E-7 on Radiographic Testing. Other divisions of U.C.C. are also members and active supporters of A.S.T.M. technical work.

Doehler Die Casting Co., J. C. Fox, Chief Chemist and Metallurgist, Toledo, Ohio.

Affiliated with A.S.T.M. as a company member since 1928, this company, through Mr. J. C. Fox, is concerned especially with the work of Committees B-6 on Die-Cast Metals and Alloys, B-7 on Light Metals and Alloys, Cast and Wrought, and B-2 on Non-Ferrous Metals and Alloys, Mr. Fox being vice-chairman of Committee B-6 and a leading participant in its work. Mr. Charles Pack, Vice-President, has been a personal member of A.S.T.M. since 1918 and is also interested actively in the work of the Society.

President Morgan Speaks at Meeting

Some 85 members and guests attended the dinner meeting held at the Electric Club in Chicago on December 2 under the sponsorship of the Chicago District Committee. The meeting was held in honor of the president of the Society, H. H. Morgan, Manager, Rail and Fastenings Dept., Robert W. Hunt Co., who was the principal speaker of the evening.

In addition to Society members and other interested visitors, the District Committee had invited the chairmen and presidents of local engineering societies and had as its guests the following: L. R. Mapes, President, Western Society of Engineers; C. R. Wagner, Chairman, American Chemical Society; E. A. Balsley, Chairman, American Welding Society; A. C. Carlton, Chairman, American Institute of Mining and Metallurgical Engineers; H. S. Van Vleet, Chairman, American Society for Metals; and L. M. Ellison, Chairman, American Society of Mechanical Engineers.

General arrangements for the meeting were made by the chairman of the District Committee, D. L. Colwell, Metallurgical Engineer, Paragon Die Casting Co., and the secretary, C. E. Ambelang, Engineer, Public Service Co. of Northern Illinois, cooperating with other members of the District Committee, in particular J. F. Calef, Chief Chemist, Automatic Electric Co., who is chairman of the program committee.

H. F. Moore, Professor of Engineering Materials, University of Illinois and Past-President and Honorary Member of the Society, took over direction of the meeting following a few remarks by the Secretary-Treasurer on some current Society activities, in particular the editing and publication of the new edition of the Book of Standards. With the wit and humor for which he is so well and deservedly known in our Society, he introduced the guest of honor, president Morgan, who gave a most interesting talk on "Materials Specifications and Their Practical Importance."

Mr. Morgan emphasized that material specifications are not specifications for machinery, devices, or structures, nor project specifications involving an assembly of such. There were many new ideas brought out in this talk that impressed the hearers; that the use of standard materials not only enabled manufacturers to produce at less cost and that consumers likewise profited economically, but also outlined the broader markets that would be developed. He emphasized that while research was used in developing materials specifications, an even larger field of research was in the developing of processing means to use materials of standard specifications and the various special applications of fabrication or manufacturing into devices, machinery, or structures.

The presentation provoked active discussion which testified to the interest of the subject and its presentation.

St. Louis District Meeting Held

At the University Club in St. Louis on November 27, there was held the first meeting of Society members and guests sponsored by the St. Louis District Committee. About 50 sat down to dinner, at the close of which the chairman of the District Committee, Past-President Hermann von Schrenk, told about the organization of the District Committee earlier in the year and spoke

of opportunities for service that lie ahead of the groups.

He first introduced the president of the Society, Mr. H. H. Morgan, who spoke appropriately and effectively on the work of the Society and the value of the Society to its members, drawing upon his own extended activities within the Society for illustration.

The Secretary-Treasurer, at the suggestion of the District Committee, briefly described the Government's Industrial Mobilization Plan and pointed to some of the ways in which the Society and its specification activities could be utilized in the event of industrial mobilization in time of emergency. The value of coordination of Federal and A.S.T.M. specification activities was emphasized.

Doctor von Schrenk then introduced the guest of the evening, Mr. L. A. Watt, Manager, Technical Service Department of the Monsanto Chemical Co., who gave a most interesting talk on plastics. He referred to the great variety of compositions that are constantly being developed in the plastics field, each with some special virtue or property that seems to fit it for certain uses. He had on display a large number of products made of plastics, ranging from many of the novelty articles to those of structural and engineering importance. Mr. Watt gave a very interesting and informative picture of present developments together with an insight into the great possibilities that lie ahead of these types of materials.

New York Meeting on Shipbuilding

At the meeting sponsored by the New York District Committee on Tuesday, December 12, two interesting talks were given, one by Paul Ffield, Materials Engineer, Bethlehem Shipbuilding Corp., dealing with "Specifications in Shipbuilding," the other by G. G. Wyland, Chief Engineer, Sparkman and Stephens, Inc., discussing metals used in yachts and small vessels.

Previous to the meeting, about 60 members and guests had dinner together. Myron Park Davis, Chief Chemist and Metallurgist, Otis Elevator Co., chairman of the District Committee, who with G. O. Hiers, Chemist, National Lead Co., secretary, had made arrangements for the meeting, introduced President H. H. Morgan, who presided. Mr. Morgan briefly mentioned some phases of A.S.T.M. work and how it was carried out. Remarks followed by Secretary-Treasurer Warwick, who spoke about the Society's publications, particularly the significance of some of the major changes being made.

Both Messrs. Ffield and Wyland, in their interesting talks to the audience of about 300, used illustrations, including motion pictures.

Mr. Wyland, whose firm was in charge of the construction of the last cup defender, "The Ranger," outlined problems covering selection of metals used in yacht work with particular reference to strength, weight, service conditions, corrosion, and life expectations. The importance of these various factors was discussed in relation to racing sail boats, cruising sail boats, cruising power boats, etc.

He also covered in detail the problems in design incidental to using alloy steels in small quantities where different materials are available at different times, and he stressed the desirability of specifying these materials by stipulating required properties instead of any specific material. The effect of electrolysis and its importance

Schedule of Meetings

Date	Committee	Place
February 26, 27	D-9 on Electrical Insulating Materials........	Washington, D. C.
February 28, 29	D-20 on Plastics........	Washington, D. C.
February 29, March 1, 2..	B-5 on Copper and Copper Alloys, Cast and Wrought	Washington, D. C.
March 13–15..	D-13 on Textile Materials	Charlotte, N. C.
March 27.....	Chicago District........	Chicago, Ill.
April 5........	D-8 on Bituminous Waterproofing and Roofing Materials....	New York City
March 4–8....	Committee Week.......	Detroit, Mich.
March 6......	Spring Meeting........	Detroit, Mich.
June 24–28....	1940 Annual Meeting..	Atlantic City, N. J.

was brought out. This was followed by a general description of metals used in yachts and building of small ships, which included the alloy steels, stainless steels, copper alloys, and aluminum alloys, as well as various brasses and bronzes.

It is planned to include an abstract of Mr. Ffield's paper in the March Bulletin.

Index to Standards—Especially Valuable in New Publication Set-Up

With the division of the 1939 Book of Standards into three parts, the question of locating quickly a particular item in the book is important. While each Part is completely indexed and two tables of contents appear in each Part, the so-called combined Index to A.S.T.M. Standards (a copy of which will be sent to each member about the middle of February) becomes still more significant. This publication is becoming much more widely used by all individuals and organizations concerned with A.S.T.M. specifications and tests.

From one standpoint the Index can be considered almost a part of the Book of Standards since it affords quickly and conveniently exact information on where a specification or test appears. To those not familiar with the Society's specification work and who wish to ascertain whether there is an A.S.T.M. standard on a particular subject, the Index is indispensable since it lists under appropriate key words titles of all A.S.T.M. tentative and standard specifications, tests, definitions, etc., together with page references to that Part of the Book of Standards where they can be found. A very detailed study of the Index is under way to make the listings and indexing as clear and concise as can be.

Broadly, the Index is divided into two sections, first, a subject list and second, a list of all A.S.T.M. specifications by serial designations, with page references given in each case. This is the first time that the page references have been given with the serial designations. Many organizations use the serial designations very widely so that this portion of the Index should be of great help.

No charge is made for copies of this publication. A number of members have standing requests for extra copies, distributing these to their associates and in other ways. Extra copies will be supplied members on request.

Tension Testing Symposium at Annual Meeting

A SPECIAL committee has been formed to organize technical discussions covering the subject "Significance of Mechanical Properties of Metals." The first technical presentation to be sponsored by the committee will take the form of a symposium covering the tension test, papers to be presented at the 1940 annual meeting of the Society in Atlantic City, June 24 to 28.

At a meeting held early in November at A.S.T.M. Headquarters, a number of those interested in the subject were present and there was discussion of the best ways and means of developing interest in the general subject. It was concluded that the first symposium should cover the tension test and that the committee will then consider other plans for future meetings. Subsequent to the meeting contacts were made with proposed authors and the following program has been arranged:

The Tension Test—C. W. MacGregor, Associate Professor, Massachusetts Institute of Technology.

The Strength Features of the Tension Test—F. B. Seely, Professor and Head, Department of Theoretical and Applied Mechanics, University of Illinois.

The Ductility Features of the Tension Test—H. W. Gillett, Metallurgist, Battelle Memorial Institute.

The chairman of the committee in charge will prepare a foreword to the symposium which is to be published in the March ASTM BULLETIN and certain other publications to stimulate interest in the subject and discussion.

Since other organizations are concerned with the general subject of the significance of mechanical properties of metals, the undertaking is in a sense a cooperative project. With the Applied Mechanics Division of The American Society of Mechanical Engineers and the American Institute of Physics especially cooperating, the committee in charge consists of the following:

J. M. Lessells, *Chairman*, Associate Professor of Mechanical Engineering, Engineering Dept., Massachusetts Institute of Technology, Cambridge, Mass. (Member of Section on Impact Testing, Committee E-1).

G. F. Jenks, Colonel, Ordnance Dept., U. S. Army, Washington, D. C.

H. F. Moore, Professor of Engineering Materials, University of Illinois, Urbana, Ill. (Chairman, Research Committee on Fatigue of Metals, and Vice-Chairman, Committee E-1 on Methods of Testing).

N. L. Mochel, Metallurgical Engineer, Westinghouse Electric and Manufacturing Co., Philadelphia, Pa. (Chairman, Committee A-1 on Steel).

R. E. Peterson, Manager, Mechanics Division, Westinghouse Research Labs., Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa. (Member, A.S.M.E. Applied Mechanics Division).

TRADE

As we pay others, so we are paid,
Life gives us back just what we give;
And so we do not live to trade,
But trade that we may truly live.
Sales may be made in money, yes,
But they are always made to men;
And so, good-will controls success,
Bringing folks back to buy again.

"Public Speaking for Technical Men"

THE IMPORTANCE of effective presentation of technical papers and reports has been stressed many times, not only from the standpoint of the speaker's own interest, but also the benefit accruing to the Society as a whole by having sessions as interesting as possible and not drawn out.

Dr. S. Marion Tucker, Professor of English, and Head of the Department of English and Psychology, Polytechnic Institute of Brooklyn, has given several series of lectures in public speaking for technical men at conventions of the A.S.M.E., and in connection with other organizations and engineering society work has stimulated interest in the subject. Recently, the McGraw-Hill Book Co., Inc., New York City, has published Doctor Tucker's book on the subject "Public Speaking for Technical Men." Just off press, this book should be of considerable interest to all engineers and technologists called upon to present technical papers or to speak in connection with non-technical activities. Any company, members of whose staff take part in society meetings, should find it of benefit to have a copy of this publication in its library.

Although the illustrative material in the book is scientific in a large sense, much of it is also general, the author having as one purpose the encouragement of the scientist or technologist to speak more often as a citizen.

While a work of this nature if it followed a routine trend, might be expected to tend to the side of dryness, Doctor Tucker from his close acquaintance with technical men has used a method which aims to hold attention—a quasi-colloquial style. Some of the chapter headings are indicative of the subjects covered: Our principal faults as speakers; the chief by-product—personality and personal power; nervousness; studying the audience, contacts with the audience; personality of the speaker—the main factor; platform manners and techniques; voice; faults in using our voices; auditorium conditions; saying things in the right way; and making our meaning clear. There is a section devoted to radio speaking. The concluding two of the thirty-one chapters are a summation, in the form of a colloquy, of the entire book and show the main ideas stressed by Doctor Tucker.

Copies of this 397-page publication can be obtained from the publishers at $3.00 per copy in cloth binding.

1940 Golf Tournament

How Many Specifications for Cement?

Report of Special Subcommittee of A.S.T.M. Committee C-1 on Cement December, 1939

EDITOR'S NOTE.—This report was presented at the meeting of Committee C-1 on Cement held in Washington, D. C., in December, 1939. The committee solicits the views of all interested parties. Comments should be sent to Mr. F. H. Jackson, Public Roads Administration Washington, D. C. The personnel of the subcommittee submitting the report is given below and immediately preceding the proposed specifications following the report there appears the personnel of the C-1 subcommittee which was appointed to review the report of the Special Subcommittee on "How Many Specifications for Portland Cement."

THIS special subcommittee consists of ten members of Committee C-1 selected from the consumer and general interest groups. It was organized a little over 1 1/2 yr. ago under the chairmanship of Prof. C. H. Scholer, Kansas State Agricultural College, who served until his resignation on February 1, 1939. Professor Scholer was succeeded by Mr. F. H. Jackson, Public Roads Administration, the present chairman. The present membership of the subcommittee is as follows:

F. H. Jackson, *Chairman*, Senior Engineer of Tests, Public Roads Administration, Washington, D. C.

M. N. Clair, Vice-President and Treasurer, Thompson & Lichtner, Co., Boston, Mass.

R. E. Davis, In Charge, Engineering Materials Laboratory, University of California, Berkeley, Calif.

P. J. Freeman, Principal Materials Engineer, Tennessee Valley Authority, Knoxville, Tenn.

M. Hirschthal, Concrete Engineer, Delaware, Lackawanna & Western Railroad Co., Hoboken, N. J.

G. O. Sanford, U. S. Bureau of Reclamation, Washington, D. C.

L. W. Walter, Inspecting Engineer, Erie Railroad Co., Jersey City, N. J.

E. C. Welden, Deputy State Highway Commissioner, Connecticut State Highway Dept., Hartford, Conn.

C. E. Wuerpel, Engineer in Charge, Central Concrete Laboratory, U. S. Military Academy, West Point, N. Y.

D. Wolochow, National Research Council of Canada, Ottawa, Ont., Canada.

NOTE.—Mr. Thaddeus Merriman, Consulting Engineer, was also an active member of this committee until his death on September 26, 1939. At the meeting of Committee C-1 held on December 1, Mr. N. T. Stadtfeld, Board of Water Supply, New York, N. Y., was appointed to fill the vacancy caused by Mr. Merriman's death.

At the meeting of the subcommittee on November 30, the U. S. Bureau of Reclamation was represented by Mr. H. S. Meissner, of the Denver office, as well as by Mr. Sanford.

The subcommittee was organized for the purpose of enabling the representatives of the nonproducers on Committee C-1 to convey to the producers and to the Society in general their thoughts on how many and what types of portland cement should be recognized in the standard specifications of the Society, as well as just what chemical and physical test limits should be set up for each type. A number of meetings have been held, the last one an all-day session on November 30, 1939, the day before the meeting of Committee C-1. At this meeting complete specifications covering five types of cement were drafted for presentation to the main committee. The specifications are presented as a part of this report.

At the November meeting, eight of the ten members of the subcommittee were present or represented. Furthermore, the ideas of the two absent members had previously been communicated in writing, making it possible to give full consideration to the recommendations of all the members, including the two who were unavoidably absent. It is inevitable that in the discussion of such a controversial subject as specifications for portland cement differences in opinion should develop. The views of the members of this subcommittee differed in regard to many details, as would be expected. However, it was found that, with the exception of one or two matters, substantial agreement could be reached on all the points at issue. The various points of view will be touched upon briefly in the discussion of the specifications which follows.

The subcommittee is unanimous in agreeing that a single specification should be developed covering the minimum number of types required. After considerable discussion it was agreed that five types would be necessary to cover the field adequately. These are as follows:

Type I.—For use where the special properties specified under types II, III, IV, and V are not required.

Type II.—For use in concrete where superior resistance to weathering is a primary requirement or where a cement having moderate heat of hydration or moderate sulfate resistance is required.

Type III.—For use where high early strength is required.

Type IV.—For use where a low heat of hydration is required.

Type V.—For use where high sulfate resistance is required.

The committee feels that there is need for a cement which can be used in cases where special properties such as superior weather resistance, low heat of hydration, etc., are not required, as well as for minor or unimportant work in general. It recommends, therefore, that type I be designated for such use and that the requirements of the present Standard Specifications for Portland Cement (C 9 – 38) be used for this type.

The committee also believes that sufficient information is available to warrant setting up requirements for a portland cement that will develop superior resistance to the action of natural weathering agencies and which will show comparatively low volume change due to wetting and drying. Cements having the same general characteristics as specified in Federal Specification SS-C-206 for Moderate-Heat of Hardening Portland Cement seem to fulfill these requirements. It therefore recommends for type II a specification following the requirements given in Federal Specification SS-C-206.

For type III the committee recommends the existing A.S.T.M. Standard Specifications for High-Early-Strength Portland Cement (C 74 – 39), with certain modifications which will be discussed later.

For type IV the committee recommends a specification quite similar to specifications for low-heat cement which have been in use for some years by the two largest users of this type of cement—the U. S. Bureau of Reclamation and the Tennessee Valley Authority.

For type V the committee believes that a specification closely following Federal Specification SS-C-211 for Sul-

fate Resisting Portland Cement should be specified. Further discussion of the proposed limits in each case will be presented later in this report in connection with the discussion of chemical and physical test limits.

The committee has considered the method of handling the question of additions to portland cement made subsequent to calcination as specified in Section 2 of A.S.T.M. Specifications C 9 – 38.[1] It is of the opinion that this procedure should be retained in the specification, slightly modified to permit the recognition and study of existing data covering the effect of additions as well as tests to be made under the sponsorship of the committee. This section has therefore been revised to permit basing the acceptance of a proposed addition on a review of existing test data from a source acceptable to the committee as an optional alternate to tests made by the committee.

The subcommittee recognizes the undesirability of too close control in specifications of the chemical composition of portland cement. It agrees that the purchase requirements should be based as far as possible upon performance tests only. However, it feels that certain properties, such as bleeding, sulfate resistance, heat of hydration, etc., which should be controlled are not adequately covered at the present time by suitable laboratory tests and that, until these performance tests have been developed, certain limitations on chemical composition must be imposed. The committee further recognizes that specifying chemical requirements by means of compound composition is not entirely satisfactory due to the influence of manufacturing operations on the extent to which the assumed compounds will form in cement. Nevertheless, it feels that a limited use of such procedure is justified as a simple method of indicating the general character of the composition most desirable for certain types.

The requirements for chemical composition have been set up in Table I of the proposed specifications. The five types of cement will be discussed in order.

Type I.—The chemical limits are identical with those prescribed in A.S.T.M. Specifications C 9 – 38.

Type II.—The chemical requirements are the same as shown in Federal Specification SS-C-206 except that a requirement limiting the calculated tricalcium silicate to 50 per cent has been added. The committee feels that limiting the percentage of alumina and the percentage of lime in this type will probably result in producing a cement more resistant to natural weathering agencies than the current standard. It feels that limiting the percentage of tricalcium aluminate to 8 per cent will certainly contribute to this end and that limiting the percentage of tricalcium silicate to 50 per cent will also be desirable.

Type III.—The limits are the same as those prescribed in the current A.S.T.M. Specifications C 74 – 39 except that a limit of not to exceed 15 per cent tricalcium aluminate has been added. This is in accordance with the requirement given in Federal Specification SS-C-201 and is for the purpose of safeguarding durability by limiting the percentage of this compound to some value which may be considered reasonable for a high-early-strength cement.

Type IV (Low-Heat Cement).—The chemical limits follow very closely the specifications of the U. S. Bureau of Reclamation. The committee feels that the fact that this organization, as well as the Tennessee Valley Authority, has successfully used this type of specification for some years should be given very serious consideration in connection with the proposal to provide a low-heat type in the A.S.T.M. standard. The compound composition requirements are set primarily for the purpose of controlling heat of hydration. In this regard they are supplemented by the proposed test for heat of hydration which will be discussed when the physical test requirements are considered.

Type V (Sulfate-Resistant Cement).—The chemical limits are identical with those shown in Federal Specification SS-C-211 which represents about as near an approach to a true sulfate-resistant cement as it seems feasible to set up at this time.

The proposed physical test requirements for each of the five types are shown in Table II of the specifications. The subcommittee is virtually unanimous in recommending that fineness requirements be included for types II, IV, and V. This is due principally to the fact that no standard test which will reveal the bleeding characteristics of portland cement is available at the present time. Bleeding seems quite definitely associated with cement fineness and so long as it is considered necessary to control this property it would seem desirable to include requirements for minimum fineness. Some difference of opinion developed as to the most desirable type of fineness test, one member feeling that a hydrometer determination would be more satisfactory than the Wagner turbidimeter recommended.

The subcommittee was divided quite sharply on the question of autoclave expansion, a number of members feeling that soundness should be controlled through the use of an autoclave test on the pat rather than by means of a quantitative test on a 10-in. neat cement bar. This group feels that sufficient data are not available to justify the use of a quantitative test limit of less than 1 per cent expansion and that until such data become available a qualitative pat test should be used. The group favoring the quantitative test feels that even though definite information correlating autoclave expansion of less than 1 per cent with service behavior may not exist at present, the use of values of the order of 0.5 per cent or less is desirable in order to insure against the possibility of delayed expansion. They point out, furthermore, that some evidence exists which indicates that, in regions where this trouble has been experienced, cements which have the best service records are those which now show very low autoclave expansions. The consensus of the meeting of November 30 was that quantitative limits of 0.5 per cent expansion should be included for types II and III, with 0.25 per cent for types IV and V.

In the matter of strength, the subcommittee has included conservative limits based almost entirely on existing standards. Alternate requirements based on tension and compression are set up and the purchaser is expected to specify the test which he desires. In the event that he does not so specify, the tension test will govern. It is quite likely that in further consideration of this proposed standard it may be found desirable either to raise or lower certain of the proposed strength limits as indicated by further study of available data.

For type IV, low-heat cement, a test for heat of hydration has been included. Although the committee recognizes that, at the present time, the method given in Fed-

[1] 1939 Book of A.S.T.M. Standards, Part II.

eral Specification SS-C-158 is not entirely satisfactory, it feels that recognition of existing tests should be given in order to encourage further research and study of the procedure.

The committee has given considerable thought to the matter of manufacturing control. It does not feel that procedures for controlling such manufacturing operations as burning, cooling, and storage should be made a part of the specifications as these are problems of manufacture. However, it feels that the purchaser should have the right to observe and record these operations if he so desires, and proposes an addition to the section on inspection which gives him this right.

The committee recommends also certain minor changes in the section on packaging and marking to eliminate the requirement that the name and amount of an addition be marked on the package, and to require that the type of cement be marked thereon.

The committee presents the appended Proposed Specifications with the recommendation that they be considered without delay by Committee C-1.

Respectfully submitted on behalf of the special subcommittee,

F. H. Jackson, *Chairman*

December, 1939

Personnel of Enlarged Subcommittee of Committee C-1 Appointed to Review Report of Subcommittee on "How Many Specifications for Portland Cement"

F. H. Jackson (*Chairman*), Engineer of Tests, Public Roads Administration, Washington, D. C.

G. A. Beckett, Riverside Cement Co., 621 S. Hope St., Los Angeles, Calif.

Joseph Brobston, President, Hercules Cement Corp , 1700 Walnut St., Philadelphia, Pa.

M. N. Clair, Vice-President and Treasurer, Thompson & Lichtner Co., Inc., 620 Newberry St., Boston, Mass.

R. E. Davis, Professor of Civil Engineering, In Charge, Engineering Materials Laboratory, University of California, Berkeley, Calif.

P. J. Freeman, Principal Materials Engineer, Tennessee Valley Authority, 125 E. Hillvale, Knoxville, Tenn.

G. O. Gardner, Superintendent, Ash Grove Lime and Portland Cement Co., Box 519, Chanute, Kans.

M. Hirschthal, Concrete Engineer, Delaware, Lackawanna & Western Railroad Co., Hoboken, N. J.

W. H. Klein, Vice-President and General Operating Manager, Pennsylvania-Dixie Cement Corp., Nazareth, Pa.

H. H. Leh, General Manager, Keystone Portland Cement Co., Bath, Pa.

H. S. Mattimore, Engineer of Materials, Pennsylvania State Highway Dept., 1118 State Street, Harrisburg, Pa.

G. O. Sanford, U. S. Bureau of Reclamation, Washington, D. C.

N. T. Stadtfeld, Assistant Engineer (Testing), Board of Water Supply, City of New York, 346 Broadway, New York, N. Y.

M. A. Swayze, Director of Research, Lone Star Cement Corp., Hudson, N. Y.

L. W. Walter, Inspecting Engineer, Erie Railroad Co., Jersey City, N. J.

George E. Warren, Vice-President and Manager, Southwestern Portland Cement Co., Osborn, Ohio.

E. C. Welden, Deputy State Highway Commissioner, Connecticut State Highway Dept., Hartford, Conn.

D. Wolochow, National Research Council of Canada, Ottawa, Ont., Canada.

C. E. Wuerpel, Engineer in Charge, Central Concrete Laboratory, U. S. Military Academy, West Point, N. Y.

PROPOSED SPECIFICATIONS FOR PORTLAND CEMENT

These proposed specifications are published as information only. Comments are solicited and should be forwarded to Mr. F. H. Jackson, Public Roads Administration, Washington, D. C.

Scope

1. These specifications cover five types of portland cement, as follows:

Type I.—For use when the special properties specified under types II, III, IV, and V are not required.

Type II.—For use in concrete where superior resistance to weathering is a primary requirement or where a cement having a moderate heat of hydration or moderate sulfate resistance is required.

Type III.—For use where high early strength is required.

Type IV.—For use where a low heat of hydration is required.

Type V.—For use where high sulfate resistance is required.

Basis of Purchase

2. The purchaser shall specify the type or types desired. When no type is specified, cement meeting the requirements of type I will be furnished.

Definition

3. Portland cement is the product obtained by pulverizing clinker consisting essentially of calcium silicates, to which no additions have been made subsequent to calcination other than water and/or untreated calcium sulfate, except that not to exceed 1 per cent of other materials may be added, provided such materials have been shown not to be harmful by tests acceptable to Committee C-1 on Cement.

Note.—Tests to determine whether a proposed addition is harmful will be carried out or reviewed by Committee C-1 on Cement for those making requests, through its Cement Reference Laboratory or other laboratory which the committee may select. As such tests are completed or reviewed, the committee will make known those additions which have been found not to be harmful. (For details regarding the conditions under which the tests or reviews will be made, address Technical Assistant, Committee C-1, Cement Reference Laboratory, National Bureau of Standards, Washington, D. C.)

Chemical Limits

4. Portland cement of each of the five types shown in Section 1 shall conform to the requirements prescribed in Table I.

Physical Test Requirements

5. Portland cement of each of the five types shown in Section 1 shall conform to the requirements prescribed in Table II.

Packaging and Marking

6. When, as specified, the cement is delivered in packages, the name and brand of the manufacturer of the cement and the type shall be plainly marked thereon. When, as specified, the cement is delivered in bulk shipments, this information shall be contained in the shipping advices accompanying the shipment. A bag shall contain 94 lb. net. A barrel shall contain 376 lb. net. All packages shall be in good condition at the time of inspection.

(*Continued on next page*)

TABLE I.—CHEMICAL REQUIREMENTS

	Type				
	I	II	III	IV	V
Magnesium oxide (MgO), max., per cent	5.0	5.0	5.0	5.0	4.0
Sulfur trioxide (SO_3), max., per cent	2.0	2.0	2.5	2.0	2.0
Loss on ignition, max., per cent	4.0	3.0	4.0	2.0	3.0
Insoluble residue, max., per cent	0.85	0.75	0.85	0.75	0.75
Silica (SiO_2), min., per cent	...	21.0	...	...	24.0
Alumina (Al_2O_3), max., per cent	...	6.0	...	...	4.0
Iron oxide (Fe_2O_3), max., per cent	...	6.0	...	6.5	4.0
Ratio, Al_2O_3/Fe_2O_3	...	0.7 to 2.0	...	...	0.7 to 2.0
Tricalcium silicate ($3CaO \cdot SiO_2$),[a] max., per cent	...	50	...	35	...
Dicalcium silicate ($2CaO \cdot SiO_2$),[a] min., per cent	...	....	...	40	....
Tricalcium aluminate ($3CaO \cdot Al_2O_3$),[a] max., per cent	...	8	15	7	5
Uncombined lime in clinker, max., per cent	*b*	*b*	*b*	*b*	*b*
Sodium and potassium oxide, max., per cent	*b*	*b*	*b*	*b*	*b*

[a] The expressing of chemical limitations by means of calculated assumed compounds does not necessarily mean that the oxides are actually or entirely present as such compounds.

The percentages of tricalcium silicate, dicalcium silicate, and tricalcium aluminate shall be calculated from the chemical analysis as follows:

Tricalcium Silicate = $4.07\ CaO - 7.60\ SiO_2 - 6.72\ Al_2O_3 - 1.43\ Fe_2O_3 - 2.85\ SO_3$.

Dicalcium Silicate = $2.87\ SiO_2 - 0.754 \times 3CaO.SiO_2$.

Tricalcium Aluminate = $2.65\ Al_2O_3 - 1.69\ Fe_2O_3$.

Oxide determinations calculated to the nearest 0.1 per cent shall be used in the calculations. Compound percentages shall be calculated to the nearest 0.1 per cent and reported to the nearest 1 per cent.

[b] Value to be inserted by the purchaser in case he desires to use this test.

Storage

7. The cement shall be stored in such a manner as to permit easy access for proper inspection and identification of each shipment, and in a suitable weather-tight building which will protect the cement from dampness.

Inspection

8. (*a*) Every facility shall be provided the purchaser for careful sampling and inspection at either the mill or at the site of the work as may be specified by the purchaser.

The following periods from time of sampling shall be allowed for completion of testing:

1-day test	6 days
3-day test	8 days
7-day test	12 days
28-day test	33 days

(*b*) The purchaser shall have the right to observe the various operations connected with the manufacture of the cement and to keep such records thereof as he may desire.

Rejection

9. (*a*) The cement may be rejected if it fails to meet any of the requirements of these specifications.

(*b*) Cement remaining in storage prior to shipment for a period greater than 6 months after completion of the tests shall be retested and shall be rejected if it fails to meet any of the requirements of these specifications.

(*c*) Type I cement failing to meet the test for soundness in steam may be accepted if it passes a retest using a new sample at any time within 28 days thereafter. The provisional acceptance of the cement at the mill shall not deprive the purchaser of the right of rejection on a retest for soundness and time of setting at the time of delivery of cement to the purchaser.

(*d*) Packages varying more than 5 per cent from the specified weight may be rejected; and if the average weight of packages in any shipment, as shown by weigh-

TABLE II.—PHYSICAL TEST REQUIREMENTS

	Type				
	I	II	III	IV	V
Fineness, specific surface, sq. cm. per g.:					
Average value, any one lot, not less than	...	1800	...	1800	1800
Minimum value, any one lot	...	1700	...	1700	1700
Soundness:					
Standard pat test	*a*	...	...	...	...
Autoclave expansion, max., per cent	...	0.50	0.50	0.25	0.25
Time of setting:					
Initial set (Gillmore), min., minutes	60	60	60	60	60
(Vicat), min., minutes	45	...	45	...	...
Final set (Gillmore), max., hr.	10	10	10	10	10
Tensile strength, psi.:[b]					
The average tensile strength of not less than 3 standard mortar briquets composed of 1 part cement and 3 parts standard sand by weight shall be equal to or higher than the values specified for the ages indicated below:					
1 day in moist air	...	...	275	...	...
1 day in moist air, 2 days in water	...	125	375	...	...
1 day in moist air, 6 days in water	275	250	...	175	175
1 day in moist air, 27 days in water	350	325	*c*	300	300
Compressive strength, psi.:[b]					
The average compressive strength of not less than 3 mortar cubes composed of 1 part cement and 2.75 parts fine testing sand by weight shall be equal to or higher than the values specified for the ages indicated below:					
1 day in moist air	...	...	1300	...	...
1 day in moist air, 2 days in water	...	1000	3000	...	...
1 day in moist air, 6 days in water	...	2000	...	800	1000
1 day in moist air, 27 days in water	...	3000	*c*	2000	2200
Heat of hydration, 28 days, cal. per g., max.	...	...	...	75	...

[a] A pat of neat cement shall remain firm and hard and show no sign of distortion, cracking, checking, or disintegration when subjected to the steam test for soundness described in Sections 14 to 16, inclusive, of the Standard Methods of Sampling and Physical Testing of Portland Cement (C 77 - 39) of the American Society for Testing Materials.[1]

[b] The purchaser shall specify the type of strength test required. In case he does not so specify, the requirements for tensile strength only shall govern.

[c] If, at the option of the purchaser, a 28-day test (with storage of 1 day in moist air and 27 days in water) is required, the average strength at 28 days shall be higher than the strength at 3 days.

ing 50 packages taken at random, is less than that specified, the entire shipment may be rejected.

Methods of Testing

10. The cement shall be sampled and the properties enumerated in these specifications determined in accordance with the following methods of the American Society for Testing Materials:

(*a*) *Chemical Analysis.*—Standard Methods of Chemical Analysis of Portland Cement (A.S.T.M. Designation: C 114 - 39)[1] and Tentative Methods of Chemical Analysis of Portland Cement (A.S.T.M. Designation: C 114 - 39 T).[1]

(*b*) *Sampling and Physical Tests.*—Standard Methods of Sampling and Physical Testing of Portland Cement (A.S.T.M. Designation: C 77).[1]

(*c*) *Compressive Strength.*—Tentative Method of Test for Compressive Strength of Portland-Cement Mortars (A.S.T.M. Designation: C 109), when specified (Section 4, Option 2).[1]

(*d*) *Fineness.*—Tentative Method of Test for Fineness of Portland Cement by Means of the Turbidimeter, (A.S.T.M. Designation: C 115 - 38 T).[1]

(*e*) *Autoclave Expansion.*—Proposed Method of Test for Autoclave Expansion of Portland Cement.[2]

(*f*) *Heat of Hydration.*—Federal Specification S-SC-158 for General Specifications (Methods for Sampling, Inspection, and Testing) Hydraulic Cements. Section F-4*n*.

[1] 1939 Book of A.S.T.M. Standards, Part II.

[2] *Proceedings*, Am. Soc. Testing Mats., Vol. 38, Part I, p. 297 (1938).

Many Projects Under Way; 1939 Active Year

(*Continued from page 10*)

cal properties is being made so that consideration can be given to include specific data in the specifications. It is possible that a paper may be developed in the near future on pearlitic and alloy malleables. The results of rather extensive research work on the welding of malleable-iron castings may be reported through the committee during the year. This subject is of considerable importance and data being developed by different companies concerned with the problem would be of widespread interest.

Ferro-Alloys

Of major importance in the work on ferro-alloys was the adoption as standard through the work of Committee A-9 of seven specifications, and the publication as tentative of revisions in two other specifications covering spiegelesisen (A 98) and ferrochromium (A 101). The standards involve ferromanganese (A 99), ferrosilicon (A 100), ferrovanadium (A 102), ferromolybdenum (A 132), ferrotungsten (A 144), and molybdenum salts and compounds (A 146).

The committee in its report indicated that there had been an interesting discussion on the advisability of preparing a standard for molybdenum compounds other than calcium molybdate. While calcium molybdate has been the chief medium of molybdenum additions, new developments in the use of molybdenum briquets and molybdenum oxides, as additive agents has already caused a shift of calcium molybdate from first to third place in volume.

The committee felt that while the tendency away from calcium salt is quite pronounced, many consumers whose practice is based on molybdate may continue its use. Therefore the committee on specifications will follow the trend during the next year and be prepared to submit at the meeting in 1940 either new specifications for these products or modify the present standard "molybdenum salts and compounds" to include briquets and oxides.

Magnetic Properties

Since the amount of space occupied by the lamination is important in the construction of cores of electrical apparatus and this factor is affected by condition of surfaces of the sheets and also a function of the coating, Committee A-6 on Magnetic Properties developed an important new method for measuring lamination factor of steel. In the field of direct current test methods, the work under way involves primarily methods and apparatus for magnetic testing and magnetized forces. The principal problem for the coming year is to discover if possible the reason for certain small discrepancies between the different types of apparatus which have been under investigation. Although these differences are in general within the tolerances given in the specifications, they are large enough to give the committee some concern.

The group on alternating test methods has inaugurated two cooperative investigations, one on the development of standard methods for measuring incremental permeability and the other a study of the possibility of using a smaller sample of material than at present specified for the determination of core losses together with the possible use of the same magnetic circuit for measuring a-c permeability. This program is likely to require more than a year for completion.

Corrosion of Iron and Steel

An important new specification was issued for zinc-coated steel wire strand (A 122 – 39 T) covering material of heavier coatings than those called for in the standard specifications A 122 – 33, this material being suitable for use as guy, messenger, span, and overhead ground wires, and electrical conductors, etc.

New tests were standardized (A 219) for determining local thickness of electrodeposited coatings on steel, including a microscopic method for determining the thickness of zinc, cadmium, copper, and nickel coatings.

A number of revisions were incorporated in the three existing specifications (A 164, A 165, A 166) for electrodeposited coatings of zinc, cadmium, and nickel and chromium on steel, and two tentative specifications were adopted as standard for zinc-coated iron and steel products.

Concerning work under way a large part of Committee A-5's program consists in continuing in its various subcommittees the research projects previously planned, a number of which have been under way for several years.

The atmospheric exposure tests of black sheets at Annapolis, the exposure tests of zinc-coated sheets and hardware at State College, Pittsburgh, Altoona, Key West, and Sandy Hook, the exposure tests of zinc-coated, lead-coated, copper-clad, and stainless steel wire and wire products now under way at Pittsburgh, Sandy Hook, Bridgeport, State College, Ithaca, Lafayette, Ind.; Ames, Iowa; Manhattan, Kans.; College Station, Tex.; Davis, Calif.; and Santa Cruz, Calif., are all being continued during the coming year, and in all likelihood for quite a few years in the future.

Total immersion tests on No. 16 gage black steel specimens immersed in sea water at Portsmouth and Key West will be discontinued since all of the specimens have now failed. The report summarizing this test, which has been under way for a number of years, is now in preparation. The samples of copper-bearing and non-copper-bearing steel tubes which were exposed to sea water at these same locations have all been assembled for examination in Washington. The subcommittee will prepare a report on these materials also. The tests on riveted plates exposed to sea water in these same locations will be continued.

During the past few years, Subcommittee VIII has devoted its attention primarily to the study of the atmospheric corrosion of protective coatings for iron and steel, principally zinc coatings. Their large program on sheets and hardware products has been considerably augmented in the last few years with an investigation of a similar nature on wire and wire products. A comprehensive report of the materials included in this latter investigation with the inspection committee's report of the results after approximately one year's exposure appears in A-5's voluminous 1939 report.

Particular attention will be given in the next year to a study of specifications for zinc coatings on hardware articles and fastenings. The desirability of breaking up the existing, rather general specification into a series of individual specifications dealing with specific products, such as nuts, bolts, etc., is being considered.

The large scope of Committee A-5's activities, particularly with respect to field exposure tests, presents certain problems in connection with the writing of field inspection reports, organization of inspection committees, cooperation with other committees conducting similar tests, etc., all of which recently have been the subject of several discussions. A small group from the Advisory Committee was appointed to study these questions. This group will consider the question of broadening the committee's activities to include corrosion investigations of iron and steel products under service conditions other than atmospheric, and in other forms than are now included in our various field tests.

Iron-Chromium-Nickel (Corrosion Resisting) Alloys

Several recommendations on the adoption of tentative standards as standard, with certain consolidations, featured the active year of Committee A-10 on Iron-Chromium-Nickel and Related Alloys. Ten specifications were involved and of these eight were combined into three specifications which will appear as standard specifications. The new chromium alloy-steel casting specifications (A 221) comprise consolidations of three previous ones covering 12, 19, and 28 per cent chromium castings (A 168, A 169, A 170); the chromium-nickel castings requirements (A 222) being a consolidation of the 24–12, 25–20, and 28 per cent chromium, 9 per cent nickel castings (A 171, A 172, A 173); and the new nickel-chromium specifications (A 223), a consolidation of the tentative specifications (A 174) and (A 175) covering alloys, 20 per cent nickel, 9 chromium and 35 nickel, 15 chromium.

Revisions were adopted in two specifications (A 176 and A 177) covering corrosion-resisting chromium sheet, strip, and plate and high-strength corrosion-resisting chromium-nickel steels, there being numerous changes involving chemistry and physical requirements in the former specifications. In August, Committee E-10 approved the committee's recommendation that the proposed guide for conducting plant corrosion tests be approved as a tentative recommended practice (A 224).

For many months the committee has been correlating and tabulating data on the properties of corrosion-resisting steels. A great deal of data have been received and when a few missing items have been assembled, these very valuable data will be prepared and published in the form most convenient for use. The former so-called "A-10 tables" issued in 1930 have been very widely used.

In the field of corrosion testing the plans are to study the method of salt-spray testing (B 117) to determine its applicability to the A-10 field. This group will also continue the development of a recommended practice for testing in boiling liquid and another for testing under conditions of atmospheric exposure. The influence of speed on the results obtained in the tension testing of the austenitic chromium-nickel steels is being established on standard bars as well as on wire and sheet samples.

The subcommittee on metallography completed its microscopic examination of the 18 per cent chromium, 8 per cent nickel types of steel after various heat treatments using various etching reagents. This report appears in the 1939 Report of Committee A-10. The committee remarks on methods of etching for carbides should be of interest to all concerned with this type of steel. This group plans to add to its work on the precipitation of a second phase in the austenitic chromium-nickel steels, studies of the cyanide and the Murakami reagents. It is further undertaking to test in an acidified copper sulfate solution samples of similar or the same steels after holding for one week at 550, 650, 750, and 850 C. to determine which of the structures obtained promote susceptibility to intergranular corrosion.

The very interesting report of the special group on the inspection of architectural structures is also published in the report giving information on behavior of corrosion-resisting steels under conditions of outdoor service. Buildings were inspected in New York, Philadelphia, and Atlantic City.

Effect of Temperature on Metals

The Joint Research Committee on Effect of Temperature on the Properties of Metals met at Battelle Memorial Institute in Columbus, Ohio, on November 3, 1939, and completed plans for a very active year.

Further studies on Creep in Tubular Members, known as Project No. 10, will be carried out at M.I.T. by Doctor Norton, as a sponsored research project of the committee.

The committee handling Project No. 13 on Properties of Metals at Low Temperatures will present a report on the round-table discussion held at Atlantic City last June on this subject (see 1939 *Proceedings*). A questionnaire designed to collect important data and experiences in this field is in course of preparation.

Project No. 16 on Relaxation is carrying out further studies on bolting and related relaxation phenomenon. Tentative plans for a session on bolting late in 1940 have been made.

Project No. 18 on Effect of Variables on the High-Temperature Properties of Metals will present a very valuable contribution to our knowledge of the creep behavior of steels, probably at the Atlantic City meeting next June. A further program of this important phase of the committee's work has been agreed upon, which will require about one year to complete.

The project on grain size, No. 20, has produced a very interesting and timely article dealing with grain size of steels. The article has been prepared especially for engineers interested in the effect of temperature on metals, but it is believed it will appeal to many others. Early publication is planned.

Project No. 21 covers a listing of high-temperature testing apparatus and methods in this country. Although prepared mainly for the use of the committee, it may be of interest and value beyond the committee.

A statement showing the very considerable amount of work carried out on the 0.35 per cent carbon steel known as K-20, listing both published and unpublished work has been prepared in Project No. 22.

Project No. 23 on non-ferrous metals and alloys will thoroughly study the position of these materials in the field of high-temperature applications, and plans needed research on such materials.

Project No. 24 will deal with the influence of time, temperature, and stress on the ductility of 0.50 per cent molybdenum steels; and Project No. 25 will make a comparison of numerous short-time testing methods now in use or proposed.

In its 1939 report the committee included in appended papers details of certain projects including the one dealing with torsion creep tests for comparison with tension tests on a carbon-molybdenum steel, further details of Project No. 17 giving experiments of a proposed acceptance test: effect of grain size, and correlation of test results for various types of high-temperature tests carried out for the Joint Research Committee.

Chemical Analysis of Metals

Committee E-3 which is charged with the development of standard methods of chemical analysis of metals continued its active program. The newly prepared methods of sampling ferro-alloys (E 32) were accepted as tentative in 1939 and these methods, together with the methods accepted late in 1938 covering chemical analysis of ferro-alloys, were included with the other 17 items in the charge of the committee in the 1939 edition of the volume on Chemical Analysis of Metals, which is the only book where these methods are published.

Subcommittees are engaged in studying methods for the determination of aluminum, lead, columbium, and selenium in steel. Work is being continued on the revision of the present standard methods for the analysis of non-ferrous alloys and metallic materials for electrical heating. The committee is also cooperating in the preparation of the program for the Symposium on Analytical Chemistry to be held in Atlantic City, June 24 to 28, at the annual meeting of the Society.

Metallography

Intensive work on the part of Committee E-4 on Metallography resulted in the issuance of two new tentative methods or recommended practices, in each case replacing existing standards. These are methods of preparation of metallographic specimens (E 3), and standard rules governing the preparation of micrographs of metals and alloys, including recommended practice for photography as applied to metallography (E 2).

The committee also acted to revise the tentative grain size chart for classification of steels (E 19). This new tentative method supersedes the standard E 19 – 33 and the tentative E 19 – 38 T. The classification comprises two sets of charts, one of them intended for use with any procedure for determining austenite grain size, the other consisting of a series of photomicrographs showing the structures found in the carburized case in a carburizing (McQuaid-Ehn) test. These two charts cover the same range of sizes, with identical designations (Nos. 1 to 8).

The committee also sponsored a photomicrographic exhibit at the annual meeting in which a great deal of interest was noted.

Copper and Copper-Alloy Wires

Committee B-1 on Copper and Copper-Alloy Wires for Electrical Conductors completed an active year involving the publication of two specifications as tentative, one covering Fig. 9 deep-section grooved and Fig. 8 copper trolley wire for industrial haulage (B 116), and the other, soft rectangular and square copper wire for electrical conductors (B 48), the latter superseding the former standard with this same designation. Two of the committee's tentative specifications were adopted as standard covering hard-drawn copper alloy wires for electrical conductors (B 105) and bare, stranded copper cable—hard, medium-hard, or soft (B 8), the standard with this same designation having been withdrawn. Seven specifications for various types of copper wire, copper rods, and trolley wire were revised and will appear in their latest form in Part I of the new Book of Standards. These changes involve hard-drawn, medium hard-drawn, and soft copper wire (B 1, B 2, and B 3), wire for electrical purposes (B 33), hot-rolled copper rods for electrical purposes (B 49), and bronze trolley wire (B 9), and copper trolley wire (B 47). The committee is continuing the development of specification requirements for rope lay cable and the study continues on use of lead or lead-alloy coverings for protecting copper wire which is expected to result in standardized requirements. Tin-coated, hard-drawn, medium-hard drawn, and alloy wires for electrical conductors are being investigated and a group has been formed to investigate proper bend testing equipment and methods of test.

Non-Ferrous Metals

The tentative specifications for rolled zinc (B 69) in the charge of Committee B-2 on Non-Ferrous Metals and Alloys were adopted as standard replacing the former standard adopted in 1929. These specifications cover three types of commercial rolled zinc: coils or sheets cut from strip, pack rolled zinc, and zinc plates such as boiler and hull plates. Subsequent to the annual meeting the committee's recommendation to publish as an A.S.T.M. tentative specification nickel-copper alloy plates, sheets, and strips was approved and issued under the designation B 127. In its report the committee submitted proposed tentative specifications for solder metal in grades of tin, lead, and tin-lead antimony alloys, these still being under consideration in anticipation of being referred to the Society shortly for approval.

Corrosion of Non-Ferrous Metals and Alloys

One of the important accomplishments of Committee B-3 on Corrosion of Non-Ferrous Metals and Alloys was the completion of a tentative method of salt spray testing of non-ferrous metals (B 117). This committee is continuing its attempts to outline methods for the guidance of those who wish to use the alternate immersion and total immersion tests.

There will shortly appear in the Society's *Proceedings* the final report of Subcommittee VIII on the very extensive research program involving galvanic and electrolytic corrosion which has been under way at various locations, including three types of atmosphere—rural, industrial, and

seacoast—for seven years. Reports have been previously published at the end of the one- and three-year periods. The valuable and important data resulting from this work is being recorded in the form of extensive tables, with committee discussion.

In connection with the conclusion of this research investigation in which many of the committee members have participated, mention should be made of the loyalty of the two subcommittee chairmen in charge during the investigation: first, the late C. H. Hippensteel, who served from 1932 to 1937, and his successor, L. J. Gorman.

One of the important new research projects established by the committee involves testing of six metals in each of three solutions involving normal sodium chloride brine, normal sulfuric acid, and normal sodium hydroxide; tests to be made in aerated and nonaerated solutions at 35 C. by various cooperating laboratories.

Electrical-Resistance Alloys

The active work of Committee B-4 on Electrical-Heating, Electrical-Resistance, and Electric-Furnace Alloys during the year resulted in the acceptance of a new A.S.T.M. tentative standard covering the testing of nickel and nickel-alloy wire and ribbon for electronic tube filaments (B 118) and the revision of the tentative method of test for flexivity of thermostatic metals (B 106).

Two tests were adopted as standard, one for linear expansion of metals (B 95), the other covering temperature-resistance constants of sheet materials for shunts and precision resistors (B 114).

Several revisions in other committee specifications were adopted covering change of resistance with temperature of metallic materials for electrical heating (B 70), accelerated life test for metallic materials for electrical heating (B 76), and specifications for two types of drawn or rolled alloys (B 82) and (B 83).

Study of the effects of various ceramics and cements upon the life of electrical heater element materials is continuing. A study is being made of a constant temperature life test method which will be more applicable for electric furnace heating materials than the present constant voltage life test method.

The committee has taken up the study of test methods for electrical contact materials. This is a very large field and the committee will confine itself at the present to specific materials and a current range from 0.1 to 50 amperes.

Tests on thin strip materials used in radio tubes are also being studied.

Committee B-4 has been designated by the A.S.T.M.-A.S.M.E. Joint Research Committee on the Effect of Temperatures on Metals to work out test methods and specifications for non-ferrous materials for temperatures exceeding 1000 F. The committee will outline an adequate program for bend and tension tests.

Work is being done on the determination of strength of thermostatic metals at various temperatures.

A study is also being made on the strength of cathode sleeves for radio tubes. Two types of instruments have been constructed and good agreement has been obtained on tests in two laboratories.

Copper Alloys

The extensive report submitted at the annual meeting by Committee B-5 on Copper and Copper Alloys, Cast and Wrought indicates to some extent its active year. The work of various subcommittees resulted in six new tentative specifications covering leaded brass sheet and strip (B 121), copper-nickel and copper-nickel-zinc alloy sheet and strip (B 122), beryllium copper bars, rods, sheet, strip, and wire (B 120), copper-base-alloy forging rods (B 124), nickel-silver sand casting alloys (B 123), and classification of cast copper-base alloys (B 119).

Three specifications were adopted as standard covering sheet: copper-silicon alloy (B 97), copper-silicon alloy rods, bars, and shapes (B 98), and copper-silicon alloy wire for general purposes (B 99).

ACTIONS AT WINTER MEETING

At the winter meeting of Committee B-5 in New York City, December 11 and 12, all of its standards were reviewed and comparison made with the corresponding Government specifications in an attempt to correlate the specification requirements. As a result various changes in the Government specifications are being suggested to responsible bureaus to insure the use of the best available commercial materials on Government contracts.

Changes were recommended (subject to letter ballot) in the following specifications: brass sheet and strip (B 36) to reduce the copper content of alloy No. 8 from 64.5 to 64.0 per cent, and to include the latest commercial tolerances as approved by the Copper and Brass Mill Products Assn. The latter changes are intended to be made in the specifications for leaded brass sheet and strip (B 121), phosphor bronze sheet (B 103), and copper-nickel-zinc and copper-nickel alloy sheet and strip (B 122). It is also recommended that B 103 be advanced to standard. Standards B 19 on cartridge brass and B 20 on cartridge brass disks will be revised in the near future to agree with the new Army specifications on these materials. This is in line with the desire of the Army to have these specifications maintained in active form.

The tentative specifications for beryllium-copper rods, sheet, strip, and wire (B 120) will be revised to include the latest commercial tolerances. It is also recommended that the specifications on copper-silicon alloy plates and sheets (B 96) and on copper-silicon alloy sheet (B 97) be revised to include information on the weights of the various alloys covered. These same changes will be offered in the specifications for copper-silicon alloy rods, bars, and shapes (B 98), and copper-silicon alloy wire (B 99).

Specifications for naval brass rods for structural purposes (B 21) are in the process of revision to include two or more leaded alloys. A proposed standard on copper rods and bars for general purposes was submitted for discussion. This will embrace two grades—tough pitch copper and oxygen-free copper (as determined by the absence of cuprous oxide at a magnification of 75×). Requirements for brass wire for general use have also been drafted.

The tentative specifications on copper and copper alloy seamless condenser tubes and ferrule stock (B 111) are to be changed to include four grades of admiralty and aluminum brass, one an alloy without arsenic, antimony, or phosphorus and three other grades each with small

amounts of but one of these elements. The standard on Muntz metal tube plates (B 57) will also be revised accordingly. Changes of a similar nature will be submitted in seamless copper boiler tube requirements (B 13).

The standard specifications on seamless copper tubes (B 75) are being revised to include two grades of copper, namely, oxygen-free copper and arsenical copper containing from 0.15 to 0.50 per cent of arsenic.

In order to effect better agreement between the tentative specifications on brass pipe, standard sizes (B 43), and the corresponding Government specifications, various changes in the composition of the different alloys, methods of tests, and tolerances will be made.

The standard specifications on copper-base alloys in ingot form were revised to include a new list of 23 alloys as compiled by the Non-Ferrous Ingot Metal Institute and two additional commercial alloys which completely covers the entire field of commercial alloys. It is planned to have new casting specifications covering all of the existing and new alloys ready for consideration at the next meeting. Proposed specifications for leaded high-strength yellow brass (manganese bronze) castings should be ready for approval shortly.

Die Castings

Committee B-6 on Die-Cast Metals and Alloys revised and continued as tentative three of its specifications covering lead- and tin-base alloy die castings (B 102), aluminum-base alloy die castings (B 85), and magnesium-base alloy die castings (B 94).

The committee's report included chemical analyses and physical properties test data on three new zinc and four magnesium alloys to be tested in the committee's corrosion program; also the ten-day 95 C. steam data for the zinc alloys.

Committee B-6 expects to recommend minor changes in the specifications for die castings of lead- and tin-base alloy and magnesium in order to keep pace with the developments in the art. Additional exposure tests are to be made on high purity zinc-base die-casting alloys.

Of considerable importance will be a review of the various finishing methods used for die castings. These include anodic treatment, corrosion inhibitors, baked and unbaked organic finishes. The research work on exposure has not involved the use of protective coatings and finishes on die castings. Arrangements are to be worked out to make some exposure tests on die castings finished in various ways.

It also appears necessary to study the possibility of injection molded or plastic finishes over die castings. By this process, the die casting is used as an insert in the mold and the finish is injected into the die wholly or partly surrounding the part. The advantage of plastic molded finishes is that their original appearance may be restored by buffing or by simple cleaning methods.

Injection molding of plastics in which parts are virtually die cast using organic materials instead of metals is becoming prominent. It becomes necessary to define these two fields and show advantages and disadvantages of these two materials for specific uses. It is proposed that several members of the committee make a survey of this field which should help to show the inter-relation of these two processes.

These developments are very new in the industry and the attention to be given them indicates that Committee B-6 is sensitive to trends in the industry. The committee is cognizant of the improved methods of control on the chemical composition of die castings and it proposes to study spectrographic methods which may make it unnecessary to carry out steam chest tests and make routine atmospheric corrosion tests on die casting alloys. The subcommittee on lead- and tin-base alloys is planning some round-robin tests on spectrographic determination of impurities in the alloys to be standardized by this committee.

Light Metals and Alloys

Of the four new tentative specifications developed by Committee B-7 on Light Metals and Alloys, two, covering aluminum alloy ingots for remelting (B 24) and aluminum for use in iron and steel manufacture (B 37), were revisions of standards, the two new items covering aluminum-base alloys in ingot form for die castings (B 125) and aluminum manganese alloy sheet and plate (B 126). A number of revisions were incorporated in other specifications in the charge of the committee and one item covering magnesium ingot and stick for remelting (B 92) was adopted as standard.

The committee plans to renew work on the effect of impurity variations on the properties of aluminum-base alloys and will continue projects on methods of testing anodic coatings. Requirements for determining coating thicknesses by weight measurements have been drafted.

Cement Meeting in December

Committee C-1 on Cement has given much attention to the question of specifications for cement and the special subcommittee, which had been appointed to consider and report on this subject, just recently presented to C-1 its recommendations as to the number and nature of the specifications which that subcommittee thought necessary. The recommended specifications are now being studied by C-1. Arrangements have been made to secure publicity for those specifications and provide a full discussion of important items relating thereto at a committee gathering in the near future. Comments are being invited from interested parties outside of C-1. (The proposed specifications and the subcommittee's report relating thereto are published in this issue of the BULLETIN.)

Following a lengthy series of cooperative tests, the chemical test methods (C 114) were increased by the addition of new tentative alternate methods for determining free calcium oxide in cement. C-1 has also decided that, subject to its letter ballot, there will be submitted to the Society a recommended ammonium chloride method as a tentative alternate method for the determination of silicon dioxide, calcium oxide, and magnesium oxide. The proposed method was carefully studied by 17 laboratories. Chemical studies also included work, still in progress, in search of suitable methods for the determination of Vinsol resin and tallow in portland cement. A recommended order and manner for reporting the results of chemical determinations were adopted.

The specifications for high-early-strength portland

cement (C 74) were revised by deleting the final setting time requirement.

The specific gravity test is not a part of the present A.S.T.M. standards for portland cement, but is being used in studies of concrete. On that account, there was added to the physical test methods (C 77) a method for the determination of specific gravity.

Committee C-1 undertook a program of tests, in accordance with the provisions of the portland cement standard (C 9), to determine whether a certain material might be considered as nonharmful when used as an addition, subsequent to calcination, in the manufacture of portland cement. The tests, performed by the Cement Reference Laboratory, were almost completed by the end of the year.

The Cement Reference Laboratory continued its sixth tour of inspection among cement laboratories. The results of tests on Comparative Sample No. 2 were reported, and a third comparative test sample was distributed by the Reference Laboratory to 220 laboratories. Test results, received from nearly all of the laboratories, have been summarized into a report which will soon be available for distribution to the participating laboratories.

Studies of plastic mortar compression tests were continued. A group of laboratories completed a cooperative investigation, using 5 cements. This investigation included pebble concrete among the mixes. Additional work was done by some of the laboratories in the endeavor to learn more about bleeding and relative water capacity of different cements, as well as methods for the measurement thereof.

C-1 approved, for submission to the Society, a revision in the standard for masonry cement (C 91). This proposal shortens the final setting time requirement and adds an optional nonstaining requirement and a test therefor.

Work was continued in an extensive study of volume change and the affecting variables.

Fire Tests of Materials

The current activities of Committee C-5 on Fire Tests of Materials and Construction include consideration of minor revisions of the specifications for fire tests (C 19), chief among which is the proper location of the thermocouples in the test furnace and the protection to be afforded to the junction and the wiring. It appears that there has not been uniformity of practice in applying the specifications.

With the hope of reconciling certain difficulties of application and meeting objections that have prevented an agreement on proposed methods of testing wood, both natural and treated, to determine its fire-resistiveness, five laboratories, working independently, have undertaken a series of tests on specially prepared samples, in accordance with a program and a method developed by Prof. W. J. Krefeld of Columbia University. The research work is nearing completion and will be followed by analysis and comparison of the results to determine the practicability of the method and the probability of uniformity in the results.

A specification for the testing of doors, and other forms of interior wall-opening protectives serving to prevent the spread of fire has been under discussion, being modified from time to time in an endeavor to secure general acceptance.

For the purpose of setting up suitable specifications for tests to determine the fire and fume hazards of materials to be used as acoustical or similar finishes, and of sound or heat insulating materials in the interior of buildings a series of tests has been made and is still under way at the National Bureau of Standards by S. H. Ingberg, and at the Forest Products Laboratory by T. R. Truax. Three methods are being studied: (1) that prescribed by Section F-2-c of Federal Specification SS-T-302, essentially the same as that used by the New York City building authorities; (2) what might be described as a chimney test, a vertical space enclosed with the material under test; and (3) a tunnel test in which the material forms the ceiling of a slightly inclined horizontal box. While considerable data have already been gathered by which the materials may be classified as to fire resistance, it is deemed inadvisable to make it public at the present time.

It is expected that the committee's tentative specifications for fire-retardant properties of wood for scaffolding and shoring (C 132), with some modification found desirable in the light of experience, will be recommended for adoption as standard.

Lime

Recommendations of Committee C-7 on Lime during the past year involved the adoption as standard of the tentative specifications for sand for use in plaster (C 35) with certain changes clarifying some of the requirements. Also the specifications for quicklime and hydrated lime (C 53) and (C 54) both for use in water treatment are combined into a single standard issued under the designation of C 53 – 39.

Another major accomplishment of the committee was the development of the Symposium on Lime, comprising eleven technical papers presented at the Columbus, Ohio, Spring Meeting. This symposium has been issued as a special publication.

The committee continues its study for proposed specifications for quicklime for causticizing leached liquors in the soda-pulp process for the manufacture of paper, for quicklime for use in the manufacture of paper pulp where the precipitated carbonate is employed as a pigment or filler, and of the proposed method for determination of available lime in high-calcium quicklime and hydrated lime by the rapid sugar test.

Refractories

A number of important actions were taken on the recommendation of Committee C-8 on Refractories which has been active in keeping test methods up to date and in making revisions necessitated by changes in manufacturing technique, quality of products, and new materials. The test for determining the load-bearing properties of refractories at elevated temperatures has been revised completely—the standard method C 16 being replaced by the new tentative standard (C 16 – 39 T). Portions of the old procedure pertaining to the testing of silica brick were dropped, the present furnace design was retained but two new types of furnaces were added, one being electrically

heated, the other for use with either gas or oil as a fuel, and other changes made.

Four of the specifications were revised and four tentative standards were adopted, two of which involve symbols for heat transmission and certain definitions of terms. Previous existing revisions in three standards were also incorporated. These involve fireclay brick for malleable furnaces (C 63) and for stationary boiler service (C 64); also refractories for the construction of incinerators (C 106).

The committee has voted favorably to recommend the withdrawal of the standard test method for porosity and permanent volume change in refractory materials (C 20) and to replace it with a new tentative standard on method of test for apparent porosity, water absorption, apparent specific gravity, and bulk density of burned refractory products.

The committee has worked on standardization of size and dimensions of standard pyrometric cones with the idea eventually of being able to draw up specifications for use by manufacturers, particularly to supply the trade with the small test cones Nos. 19 to 42 for use in determining P.C.E. according to the method for pyrometric cone equivalent of refractory materials (C 24).

Tentative standard definitions for insulating fire brick, insulating block, calcining, and burning (firing) were approved by the committee.

The Annual Report of Committee C-8 for 1939 contained industrial surveys on: Conditions surrounding refractory service in lime burning; conditions surrounding refractory service in continuous plate glass and window glass furnaces. Another study is in progress pertaining to the zinc industry, with an industrial survey report anticipated in the next year or two.

Concrete and Concrete Aggregates

In its extensive 1939 report Committee C-9 on Concrete and Concrete Aggregates included a number of important recommendations, one involving the test for soundness of aggregates by use of sodium sulfate or magnesium sulfate (C 88). Also published as information was a proposed test for aggregate soundness by use of magnesium sulfate, formulated by C. E. Wuerpel in an effort to overcome difficulties encountered in using the existing tentative method (C 88). There was included in the report a proposed method of test for organic impurities in sand by pH value, developed by Ira Paul. Two papers, one by Mr. Paul, the other by Mr. Wuerpel, were published in support of these respective methods.

Three other technical papers were appended to the committee's report, one on water vapor permeability by H. J. Barre, another on statistical analysis of compression tests by H. W. Leavitt and H. A. Pratt, and a third on measuring the passage of water through concrete by W. M. Dunagan.

Six existing standards were revised and eleven tentative standards were adopted as standard involving two specifications for concrete aggregate (C 33) and lightweight aggregate for concrete (C 130) and eight tests for specific gravity of coarse and fine aggregates, yield, clay lumps, abrasion, coarseness, consistency, and sieve analysis.

A number of active projects are under way as a result of which the committee expects to recommend for publication as tentative during 1940 six new test methods and one new specification. These methods would cover: sampling wet concrete; making concrete test specimens from vibrated concrete; measuring cores drilled from concrete structures; determining the volume of air entrained in concrete; freezing and thawing of concrete; soft particles in coarse aggregate; and determining the efficiency of a curing agent for concrete. The expected specification is for manufactured sand.

During the year the Sanford E. Thompson Award was established by Committee C-9 as an annual recognition to the author or authors of a paper of outstanding merit on concrete or concrete aggregates presented at an annual meeting of the Society. The award is named in honor of the first chairman of Committee C-9. The purposes are to stimulate research, encourage the presentation of results of investigations that extend the knowledge of concrete and concrete aggregates, and to recognize meritorious effort. The award is $50.00 with a suitable certificate. The first award will be made at the 1940 annual meeting of the Society.

Gypsum

In order that the specifications and tests in its charge would be up to date in the 1939 Book of Standards Committee C-11 on Gypsum recommended the adoption as standard of revised specifications for sand for use in plaster (C 35) and also the incorporation of revisions in the specifications for gypsum plasters (C 28) and methods of testing gypsum and gypsum products (C 26).

Certain changes and definitions of terms were adopted and there was also set up a tentative revision in the methods of testing gypsum and gypsum products (C 26) to provide test procedures for determining wood fiber in wood-fibered plaster. These are desirable since the plaster requirements (C 28) specify not less than 1 per cent by weight of wood fiber in wood-fibered plaster. The elutriation and ammonium acetate methods were suggested, but since the former is simpler and quicker, it was offered as a tentative revision.

Mortar

Although but little can be reported as accomplished, Committee C-12 on Mortars for Unit Masonry has been quite active during the year. Subcommittee II on Methods of Test has functioned through working subcommittees such as the one on workability and plasticity and through discussion at meetings of Committee C-12. Subcommittee III on Specifications had sponsored a cooperative series of tests on strength and flow after suction of masonry cement mortars and 1:1:6 cement-lime-sand mortars. The group on workability and plasticity distributed samples of a "calibrating mortar" for the 10-in. flow table and the results demonstrated that failure to comply with the requirements for mounting flow tables had much to do with the variation in results reported. This subcommittee also prepared a proposed specification for mortar and an accompanying "primer" explaining the purpose and theory of the specification requirements. These documents were submitted for publication as in-

formation but this action was later rescinded to provide more time for discussion.

Subcommittee IV on Aggregates prepared a proposed specification for aggregates for masonry mortar which was issued as tentative (C 144). The subcommittee concerned with volume change has considered a program of research including study of the autoclave test for soundness, accelerated measures of shrinkage, etc.

A new standing subcommittee on admixtures has been established and has reported a proposed definition for admixtures for mortar.

Glass and Glass Products

Although there have been several committee meetings and considerable interchange of correspondence since Committee C-14 on Glass and Glass Products was organized in 1937, there were no specific recommendations from this group until the August, 1939, meeting of Committee E-10 on Standards, when not one, but four new tentative methods were presented covering chemical analysis of glass sand (C 146), hydrostatic pressure test on glass containers (C 147), polariscopic examination of glass containers (C 148), and thermal shock test on glass containers (C 149). The method of chemical analysis, first mentioned, will fill the need for uniform methods for determining impurities, and the other three items cover important properties of glass containers, various factors which are important in testing these products having been considered by the committee which is set up on the same basis as other standing committees of the Society, namely, with adequate representation from consumers, producers, and the general interest group.

Manufactured Masonry Units

A number of accomplishments in the field of standardization were reported through the active work of Committee C-15 on Manufactured Masonry Units including a new specification for solid load-bearing concrete masonry units (C 145) which cover such units made from portland cement and suitable aggregates, with two grades, A and B, classified on the basis of strength. The method of sampling and testing concrete masonry units (C 140) and three specifications covering sand-lime brick (C 73), concrete units for construction of catch basins and manholes (C 139), and hollow non-load-bearing concrete masonry units (C 129) were adopted as standard. Certain revisions were adopted in the methods of sampling and testing brick (C 67) and specifications for hollow load-bearing concrete masonry units (C 90), and in August, further revisions were approved in the methods of testing brick to be set up as tentative giving detailed freezing and thawing test procedures.

At the same time changes were accepted for publication in the tentative specifications for building brick (C 62) to require more rigid properties as to strength, absorption, and saturation coefficient.

WASHINGTON MEETING—DECEMBER

At a well-attended meeting held in Washington, D. C., on December 12, 1939, Committee C-15 held a round-table discussion to review recent research on concrete masonry units, clay building brick, and efflorescence on masonry. The discussion relating to concrete masonry was lead by Mr. P. M. Woodworth.

Mr. Woodworth gave an illustrated address describing in detail studies recently completed at the University of Wisconsin on the physical properties and frost resistance of concrete masonry units. The results of the tests showed the effects of differences in proportions, kind of aggregate, and method of forming (tamping or vibration) on the properties of concrete blocks. Investigations of the fire resistance and the compressive and transverse strengths of masonry walls also were discussed, including those carried out at the Underwriters Laboratories, the University of Illinois, and the Portland Cement Association. Mr. Woodworth enumerated the functions required of masonry walls in service, such as strength, fire resistance, durability, etc., and summarized the available data showing the relations between properties of the units and service properties of concrete masonry.

Messrs. J. W. McBurney, J. H. Hansen, and H. G. Schurecht lead the discussion on the frost resistance of building brick. Mr. McBurney summarized the results of extensive investigations carried out during the past ten years at the National Bureau of Standards. He showed the relations which had been found between such properties as compressive strength, water absorption, and saturation coefficient of brick and their resistance to frost action, as indicated by the results of tests of over 2000 brick specimens obtained from over 200 plants scattered throughout the United States. Mr. Hansen discussed the paper by McBurney and described difficulties sometimes incurred in the application of the specifications covering clay building brick (C 62 – 39 T). Professor Schurecht described recent investigations made at Alfred University on the properties of Hudson Valley brick as affected by composition and heat treatment. He also reviewed data obtained by him on the moisture content of bricks exposed to the weather and on the relations between various physical properties which may be determined quickly and the frost resistance of Hudson Valley brick.

Thermal Insulating Materials

Committee C-16 on Thermal Insulating Materials is proceeding actively with the development of test methods for nearly all forms of insulating materials excepting those used for building walls, which are outside the scope of the committee. At a meeting held in Washington, October 26 and 27, the chairmen of the subcommittees dealing with particular types of insulation reported substantial progress in reaching an agreement as to test methods. Tentative methods have been studied and tried out in the laboratories of several manufacturers.

The establishment of test methods is the first step toward the ultimate objective of the committee, namely, the writing of specifications for insulating materials.

Another important activity is that of a joint committee on the measurement of thermal conductivity. The committee includes representatives from the American Society of Heating and Ventilating Engineers, the American Society of Refrigerating Engineers, and the National Research Council. The committee, under the chairmanship of Mr. F. C. Houghten, has made a great deal of progress

in reconciling the many differences of opinion as to how thermal conductivity can be measured, and expects in the near future to agree on possibly three methods, each appropriate for a particular type of material.

During 1939 the committee cooperated in the Symposium on Thermal Insulating Materials, consisting of four important papers which have since been issued in a separately bound volume by the Society.

Paints, Varnishes, Lacquer, and Related Products

Five new tentative standards were issued through the work of Committee D-1, one covering shellac varnishes (D 360) replacing two former specifications; the other specification covers zinc dust for use as a pigment in paints (D 520) with companion methods of chemical analysis (D 521). The other two tests cover specular gloss of paint finishes involving separation into five gloss classes (D 523) and elongation of attached lacquer coatings with the conical mandrel test apparatus (D 522).

Some nine specifications and tests existing previously as tentative were adopted as standard and a number of revisions in standards were adopted with others accepted as tentative. Quite a number of standards and tentative standards were withdrawn, particularly in the field of pigments since they were superseded by new or revised specifications.

An important accomplishment of the committee was the development of the Symposium on Paint Testing which is published in this BULLETIN. Two papers presented at the June meeting of the committee were published in the October BULLETIN, one on "The Status of Linseed Oil" by R. D. Bonney, the other dealing with "Liquid Driers" by W. T. Pearce.

A number of standardization projects which the committee has under way were listed in the August BULLETIN. A new subcommittee has been organized on drying oils to develop standards for purity and quality of raw drying oils, methods of test for processed and blended drying oils, and performance tests for all types of oils, which will ultimately make it possible to write specifications which do not require oils from a specific source. Work on revisions of terms relating to paint specifications (D 16) is under way and the very active work on accelerated tests continues, the group on house paints planning to continue its work on color retention studies. The group on enamels completed a study of six enamels with the accelerated results showing reasonable correlation. In this field also a project is developing to survey the present use of service tests of the accelerated type that are being used by manufacturers and consumers, the object being to bring to the fore methods which should be studied by Committee D-1.

The subcommittee on varnish has a very active program involving the determination of color, methods of measuring adhesion, chemical resistance of furniture and floor varnishes, and related items. Another D-1 project involves the development of a set of pictorial rusting standards, a special committee on which is cooperating with other interested D-1 groups. At a recent meeting a number of panels were reviewed, including Swedish rusting standards. The subcommittee is going ahead with its work on the premise that the results will involve the primary types of rust and not all types. Research work on painting structural iron and steel is proceeding with a number of panels treated and exposed.

Petroleum Products and Lubricants

Research work carried out by Committee D-2 on Petroleum Products and Lubricants resulted in three new tests, issued as tentative, involving determination of carbon residue (Ramsbottom method) (D 524), gum stability of gasoline (D 525), and tetraethyl lead in gasoline (D 526.) The tests for acid heat of gasoline (D 481) and for knock characteristics of motor fuels (D 357), both as revised, were adopted; also, viscosity-temperature charts for liquid petroleum products (D 341) and the method for conversion of kinematic viscosity to saybolt universal viscosity (D 446), revisions were adopted in five other standards. All of the specifications and tests in the charge of the committee were issued in the compilation of Standards on Petroleum Products and Lubricants, published in October.

The subcommittees have various problems under study, some of which are as follows: determination of dropping point of grease, revisions of methods of grease analysis and grease consistency, improvement of the lamp sulfur method, and neutralization method. The considerable work done in developing the test for aniline point is expected to result in a recommended standard method. Also, under way is work on a test for distillation of petroleum that will give a gasoline fraction large enough for determination of octane number. Work on gum will continue with cooperative work using the bomb prescribed in the gum stability test (D 525) using various metals in the gasoline. The committee also announced that a new subcommittee on turbine oils is being organized.

Gaseous Fuels

Committee D-3 on Gaseous Fuels has continued experimental research on formulation of definitions and methods. The National Bureau of Standards is working on methods for testing small wet gas meters under various conditions of operation and at various rates of flow. The results of some of this experimental work were presented by Howard S. Bean and F. C. Morey at the 1939 annual meeting of the Society, this paper to be published in the *Proceedings*.

A standard method has been proposed for the routine determination of calorific value of gaseous fuels by means of the water-flow calorimeter.

Experimental study of various types of specific gravity equipment has continued at the National Bureau of Standards. Twelve samples of such equipment have been submitted by manufacturers. Tests are being made with gases having a range of specific gravity between 0.32 and 0.72, the normal range for city gas.

A proposed standard method for determination of the total sulfur in gaseous fuels by the referees' apparatus is being tried in various laboratories. A new method of determining organic sulfur by catalytic hydrolysis was described in a paper given at the annual meeting of the Society.

A comprehensive review of the literature on the determination of water vapor in gases was completed under the sponsorship of the committee at the Mineral Industries Experiment Station of State College, Pennsylvania, and a paper on determination of water vapor in gaseous fuels was presented by this research group at the Production and Chemical Conference of the American Gas Association in Rochester, New York, on May 24, 1939.

During the coming year it is expected to distribute standard samples of gas for investigating methods of gas analysis. The purpose of this plan is to determine the reproducibility that is obtained with different methods of analysis and apparatus.

Coal and Coke

Greater industrial interest in the properties of coal and in its more efficient utilization is reflected in increased activities in the development of tests by Committee D-5 on Coal and Coke.

A proposed method of test for determining the index of dustiness of coal and coke (D 547) was accepted as tentative in August. This test is designed to give information on the efficiency of treatment of coal and coke with oil or hygroscopic solutions to prevent dustiness in handling the fuel.

Studies were continued by several laboratories in cooperation with the committee on the grindability of coals by the tentative ball-mill method and by the tentative Hardgrove-machine method. Reports were published by the Bureau of Mines in Reports of Investigations 3382 and 3409 and a paper on the "Grindability of Coals Mined in the United States, Canada, and Other Countries" was issued by The Babcock & Wilcox Co.

Tests on the friability of coal by the drop shatter test method and by the tumbler test method are being conducted by the Canada Bureau of Mines. The United States Bureau of Mines published a Report of Investigations (3384) on the friability of Alabama coals, using the tumbler method.

Active research is being conducted by the subcommittee on plasticity and swelling of coal. A series of seven coking coals, ranging in rank from low volatile Pocahontas coal to high volatile Illinois coal, have been tested for expansion properties during carbonization by various methods. Ten laboratories made these cooperative tests and nine methods were used. Several methods for determining agglutinating values and plastic properties during carbonization also were tried on these samples. As a result of this investigation much progress was made in obtaining a better knowledge of test conditions that affect the expansion of coals. It is planned to undertake another series of cooperative tests on blends of two coals selected to get "borderline conditions of expansion." Methods of testing plasticity will also be included in the cooperative tests.

The subcommittee on ignitibility of coal and coke has agreed on a proposed definition of ignitibility which is necessary for the formulation of a test procedure. A group of laboratories has agreed to try several methods for determining ignitibility on the standard coals that are being prepared for the expansion and plasticity investigation.

The swelling and plasticity of coals are very important both in the selection and blending of coals for the manufacture of coke and in the study of performance of coals on different types of stokers. However, these properties are based on a number of chemical and physical factors that are not readily subjected to scientific determination. The testing procedures used are necessarily of an empirical nature and subject to many variations. Therefore, much research will be required before standard procedures can be proposed for adoption.

Road and Paving Materials

As a result of critical reviews of its specifications and tests pertaining to road and paving materials, Committee D-4 recommended a large number of actions including three new tentative standards, covering specifications for preformed expansion joint fillers for concrete (D 544), and their methods of testing (D 545), and method of test for sieve analysis of mineral filler (D 546). Also there were published in the December BULLETIN proposed methods of testing emulsion for use in densely graded cold asphaltic mixes which had been included in the report but subsequently withdrawn.

Some ten specifications and tests were revised, seven of which involve standards, the changes being adopted immediately. Ten of the tentative specifications covering various types of asphalt cement have not been revised for many years and since they were not considered suitable for adoption as standard pending further study they were withdrawn. Changes were also approved by the Society in August in specifications for asphalt filler for brick pavements (D 241) and a test for loss on heating of oil and asphaltic compounds (D 6).

Quite a number of activities are being carried on in Committee D-4. Subject to letter ballot the committee plans to propose the adoption as standard with certain editorial changes of the existing specifications for asphalt plank (D 517). A review has been in progress of the present float test; also consideration of measurement and characterization of bituminous road materials in terms of absolute viscosity tests. Proposed new methods of sampling nonbituminous materials have been prepared and circulated among the committee for comment. The methods would apply to stone, slag, gravel, and sand and stone block for: preliminary investigation of sources of supply; acceptance or rejection of source of supply, and inspection of shipments of materials. Requirements for sodium chloride have been drafted and specifications for white traffic paint are in course of preparation.

Waterproofing and Roofing Materials

Since there has existed considerable need for a standardized weathering test for bituminous materials, Committee D-8 on Bituminous Waterproofing and Roofing Materials has been studying requirements for some time and at the 1939 annual meeting had its proposed recommended practice for accelerated weathering test for bituminous materials approved (D 529). This method is intended to produce rapid deterioration under conditions simulating extreme outdoor exposure. New specifications were issued as tentative (D 491) replacing three existing specifications covering asphalt mastic suitable

for waterproofing floors of buildings and bridges, for reservoirs, waterways, subways, but not intended for use as a pavement.

The various D-8 subcommittees have studies under way involving methods of extraction and recovery of bitumen from grouts and mastics, specifications for prepared roofing and shingles, and a tabulation of cooperative results obtained on fiber analyses which is to be published as information. Work is to continue on weathering tests.

Of interest to both Committee D-4 on Road and Paving Materials and D-8, in connection with coefficient of expansion, is the indication that the Bureau of Standards would shortly issue temperature volume correction tables for tars.

Paper and Paper Products

During the year the Society approved on the recommendation of Committee D-6 on Paper and Paper Products four new tentative standards which appear in the 1939 Book of Standards, Part III, covering the following: bulking thickness of paper (D 527), machine direction of paper (D 528), water-soluble acidity or alkalinity of paper (D 548), and resin in paper (D 549). The method of test for bulking thickness of paper covers the procedure of measuring paper when placed in a pile, as for use in books. The test for resin covers procedures for both qualitative and quantitative determinations of total resins consisting of natural resins in the pulp from which the paper is made, plus any resins added in sizing.

The committee is continuing its critical study of paper testing methods, some of which have been approved by the Technical Association of the Pulp and Paper Industry, while the group on significance of test methods is preparing a monograph covering significance of tests and definitions of terms, etc. An extensive research and testing program is getting under way involving fiberboard and fiberboard containers.

Electrical Insulating Materials

During the past year Committee D-9 on Electrical Insulating Materials presented new methods of testing glass spool insulators (D 550), and of measuring shrinkage from mold dimensions of molded materials (D 551). Extensive improvements were made in numerous other test methods and specifications, particularly, the addition of a method of test for power factor and dielectric constant of natural mica, conditioning of plates, tubes, and rods for physical tests, and the measurement of oil penetration in papers.

Work is being continued in connection with the conditioning of shellac prior to testing for flow time and the round-robin tests to develop a suitable procedure for determining the acid and alkali resistance of insulating varnishes.

A revised method of dielectric strength testing of oil has been prepared and is being submitted for letter ballot.

Work is under way in regard to a dye penetration test method for determining the porosity of porcelain and methods of testing steatite.

It is proposed to work jointly with A.I.E.E., N.E.M.A., and E.E.I. in the preparation of a standard thread gage for pin type glass insulators.

Samples of insulating tubing are being circulated for measurement of the dimensions in several laboratories to determine the best method of measurement, preliminary to the preparation of standard procedure. In addition to the conditioning of plate, tube, and rod specimens for physical tests it is necessary to condition these specimens for electrical tests. The procedure for conditioning for such tests as insulation resistance, power factor, and dielectric strength is now being prepared.

A further study is to be made of the method proposed by the Association of Edison Illuminating Companies of determining tracking or burning due to low voltage currents in molded insulating materials. The results of the round-robin tests comparing the hot Rockwell test with actual punching of the specimen are being analyzed. Samples of fabric base phenolic laminated sheets are being sent out for test of product uniformity. Additional tests are also to be made on samples of paper base phenolic laminated sheets.

A proposed specification for phenolic laminated tubing for radio applications has been prepared and the specifications for phenolic laminated sheets for radio applications (D 467) are being revised to include the new thickness tolerances recommended by the National Electrical Manufacturers Association.

Work is proceeding on developing a more rapid method for determining power factor parallel to laminations of laminated materials, and a ply adhesion test of vulcanized fiber has been outlined and is to be tried out during the coming year.

The round-robin tests on measurement of power factor at ultra-high frequencies is being continued and a sample of fused quartz is being measured with the idea of utilizing it as a reference standard.

Samples of cloth subjected to various degrees of stretch are to be impregnated and samples of tape made therefrom submitted to various consumers for trial, in an effort to determine the type most desirable and if present specifications are satisfactory. The present specifications for varnished tubing are being expanded to include saturated sleeving.

It is proposed to cooperate with Committee B-4 in the measurement of mica stampings for radio tubes. Several methods of measuring and checking the tapered pins have been presented and their accuracy will be checked during a series of round-robin tests. Work is being done in connection with revising the chart for grading of natural mica and preparation of color photographs for the classification of mica.

Work is being continued on the standard conditioning chamber and the standardization of the temperature to be used in the method of measuring power factor and dielectric constant of mica. Work is also being done in cooperation with Committee D-20 on the conditioning for tensile strength and impact tests.

Plastics

Two tentative methods of test were perfected by Committee D-20 on Plastics. The first (D 542) involving index

of refraction of transparent organic plastics is intended to apply to cast, hot-molded, and sheet materials. Two procedures, refractometric and microscopic, are included, the former being indicated as preferred wherever applicable. The other method (D 543) involves a test for resistance of plastics to chemical reagents which applies to all organic plastic materials and gives provisions for reporting changes in weight, dimensions, and appearance but does not cover changes in strength, electrical properties, and the like.

Rubber Products

At the annual meeting in June and through the meeting of Committee E-10 on Standards in August, Committee D-11 on Rubber Products submitted several recommendations to the Society including new tentative standards covering rubber sheath compound for electric cords and cables (D 532), methods of testing sponge rubber (D 552), rubber cements (D 553), hard rubber products (D 530), and method of test for indentation of rubber by means of the Pusey & Jones Plastometer (D 531). These items which should be of widespread service culminate intensive work in several of the subcommittees.

Three tentative tests were adopted as standard, two covering tests for adhesion (D 413 and D 429), the other involving sample preparation for physical testing (D 15).

Of outstanding significance was the organization during the year of the new Technical Committee A on Automotive Rubber functioning as a Joint Committee of the Society of Automotive Engineers and A.S.T.M. under D-11's auspices, an announcement of which with the committee personnel appeared in the August BULLETIN. Three subcommittees of this new section are active in the field of rubber motor mountings, rubber bumper parts, and tests. The first-named group has cooperative work under way involving compression modulus testing. Work is planned on three bumper classes to be evaluated by laboratory and service tests. At one of its recent meetings, the committee decided that there should be put in course of development a suitable tear and puncture test which can be applied to rubber as used in the automotive industry, one of the requisites of such a test being indicated as speed in use.

Soaps and Other Detergents

A news account of the November meeting of Committee D-12 on Soaps and Other Detergents published in the December BULLETIN indicated many of the committee's major activities, these items covering both test methods and specifications involving textile, built, and straight soaps, dry cleaning and sulfonated detergents, metal cleaners, and nomenclature and definitions.

Six specifications were accepted as new A.S.T.M. tentative standards during 1939 covering sodium metasilicate, trisodium phosphate, palm oil bar soap, palm oil chip soap, built soap, and soap powder. Also proposed for the first time were methods of sampling and chemical analysis of special detergents.

Ten of the specifications and tests, all issued in 1938, were adopted as standard. These cover various types of chip, bar, toilet, and powdered soaps, tests for particle size, and requirements for soda ash.

Textile Materials

The work of Committee D-13 on Textile Materials has continued actively in its many fields of more or less diverse interests. Its March and October meetings were exceptionally well attended. The twenty-fifth anniversary of its organization was appropriately celebrated at the March meeting.

Three new tentative standards were issued during the year covering test methods for rayon staple (D 540), single jute yarns (D 541), and apparent fluidity of dispersions of cellulose fibers in cuprammonium hydroxide (D 539).

Revisions have been made in several standards including those relating to terms and definitions (D 123), rayon yarn (D 258), woven tapes (D 259), knit goods (D 231), Osnaburg cement sacks (D 205), asbestos yarns (D 299), asbestos roving (D 375), and cotton goods for rubber and pyroxylin coating (D 334).

During the year much interlaboratory work has been done on the collection of data and statistical analyses to determine the number of tests (sample size) required for a desired accuracy of the test result.

The committee has many important projects and studies in progress. These relate to glass yarns and tapes; asbestos fabrics; rayon tire cord; heavy woven fabrics; sampling and scouring of raw wool; wool felt; pile floor covering; heat transmission of blanketing; rayon fabrics; upholstery; cotton yarns; moisture regain and conditioning of textiles; water resistance, moth repellancy and accelerated aging of textiles; and definitions. A detailed list of standardization work in progress involving specifications and tests, and also an itemization of many studies under way were published in the December BULLETIN in the article reviewing the New York meeting of Committee D-13.

Soils for Engineering Purposes

Research and standardization projects involving soils for engineering purposes were forwarded during the year through the work of Committee D-18, with seven tentative test methods bearing the 1938 date adopted as standard. The committee had developed four proposed test methods for stabilized soils which after submission to committee letter ballot were referred to Committee E-10 on Standards for recommended approval but, because of various comments on the part of D-18 members, were referred back for consideration. The methods, published for information with the 1939 D-18 report in the *Proceedings* are as follows: moisture-density relations of soil-cement mixtures, durability of compacted soil-cement mixtures by repeated freezing and thawing, durability of compacted soil-cement mixtures by repeated wetting and drying, and stabilization of soils with emulsified asphalt.

Revisions are being developed in the methods of surveying and sampling soils (D 420). Studies are to be made of the standard test for determination of moisture equivalent (D 426). An extensive research program on the consolidation test is progressing under the auspices of Subcommittee VI on Compressibility and Elasticity, this work being of a comprehensive nature intended to cover all aspects about which any uncertainty exists, particularly with reference

to the influence of a number of factors on the consistency and reliability of results obtained. This group has developed an interesting bibliography of some 50 selected references representing probably the best on the subject. It is also much concerned with symbols in which considerable work has been done by Subcommittee I headed by W. P. Kimball.

An important accomplishment of the committee was the organization of the Symposium on Shear Testing held at the 1939 meeting with some eight papers; also the shear testing exhibit which was sponsored by Subcommittee VII, headed by F. J. Converse.

Water for Industrial Uses

A number of sessions at the annual meetings of the Society have been sponsored by Committee D-19 on Water for Industrial Uses, at which pertinent technical papers have been presented and it plans to develop another session at the 1940 Annual Meeting, June 24 to 28, Atlantic City, comprising a Symposium on Problems in the Classification of Natural Water Intended for Industrial Use. Further details of this symposium will be announced, it being planned to have a preliminary review in the March BULLETIN, followed by synopses of the papers in the Provisional Program in the May issue.

The committee is following with considerable interest work of the Boiler Feedwater Subcommittee of the Boiler Code Committee which has surveyed the operators of high pressure boilers to secure data from which conclusions can be reached as they refer to the use of inhibitors for the prevention of boiler metal cracking for boilers operating at pressures of 400 psi. and over, and when the construction is of the welded, forged, and internal caulk types.

The work under way on methods of analysis is expected to result in a recommendation at the annual meeting for a proposed method covering reports of water analysis. There has also been prepared a benzidine sulfate method which is being studied further.

Suggested revisions of the methods of sampling of plant or confined waters (D 510) are being reviewed and changes are contemplated in the six methods of determination of various ions in specifications D 511 to D 516, inclusive.

Further activities involve a survey of literature to assemble data in connection with work on sampling apparatus.

Studies are being continued on methods of determining dissolved oxygen, development of procedures for determining iron, aluminum, and manganese, and the assembling of information and data preparatory to developing standardized procedures for hardness tests.

The committee is following with considerable interest the question of forming a separate standing committee of the Society or referring to a subcommittee or a section of an existing group the standardization of test methods for the determination of the hydrogen-ion concentration (pH value).

Methods of Testing

While a good deal of progress was made by various technical committees of Committee E-1 on Methods of Testing, perhaps of outstanding interest was the consolidation into two specifications of the requirements for thermometers from a large number of individual methods of tests, particularly in the field of petroleum products. Also of much significance especially to the apparatus field was the decision to expand Technical Committee XII on Laboratory Glassware to cover laboratory apparatus in general, so that work on simplification and standardization for requirements of metalware can be fostered.

The new thermometer specifications, one a standard (E 1 – 39) and the other a tentative (E 1 – 39T) list in tabular form the requirements appearing in the A.S.T.M. tentative and standard methods of test, E 1 – 39 of course, giving those which had been covered in standard tests, while E 1 – 39 T gives requirements previously provided under tentative tests. It is planned when the tentative specification is adopted that the two items will be combined. These combined specifications should be of great benefit to all producers and users of thermometers since they give in concise, convenient form the various requirements.

Work in the Technical Committee on Consistency, Plasticity, and Related Properties resulted in revisions in the test for softening point by tapered ring apparatus (E 28). The technical Committee on Particle Size and Shape was responsible for the recommendation involving the adoption as standard of the specifications for sieves for testing purposes (E 11), covering woven-wire cloth, round-hole screen, and square-hole perforated plate screen sieves.

The work on speed of testing being carried on at the University of Illinois under E-1 auspices is being continued and it is expected that a detailed report will be presented this year.

Spectrographic Analysis

Committee E-2 on Spectrographic Analysis has been instrumental in developing and sponsoring the presentation of much information and data on the subject. The success of the all-day round-table discussion on Fundamental Methods and Technique of Spectrochemical Analysis at the last Annual Meeting bespeaks the interest in this field from widely varied industries.

In addition to sponsoring a formal symposium on this subject to be held at the 1940 Annual Meeting, the committee also is considering a number of comments received on the methods of quantitative spectrochemical analysis of high-grade pig lead (E 25), zinc for lead, iron, and cadmium (E 26), and zinc alloy die castings for minor constituents and impurities (E 27).

Radiographic Testing

Principal activity of Committee E-7 on Radiographic Testing during the year involved the development of technical data, some five papers presented at the 1939 Annual Meeting to be published in the ASTM BULLETIN or the *Proceedings*. The committee also recommended changes in the tentative methods of radiographic testing of metal castings (E 15) in order to bring these up to date. These changes were acted on at the August meeting of Committee E-10 on Standards.

A valuable abstract of 1938 literature on X-ray testing appears on page 26 of this BULLETIN.

Meeting of Color Council Scheduled

The Ninth Annual Meeting of the Inter-Society Color Council of which A.S.T.M. is a member body will be held jointly with the Optical Society of America and the American Physical Society, February 21 to 24, at the Roosevelt Hotel, New York City. Members of all the member bodies of the Society and any others interested in color are invited to attend the sessions.

While complete details of the program will be published in the Bulletins of the American Physical Society and the Technical Association of the Pulp and Paper Industry, the preliminary notice lists a Technical Session on Spectrophotometry in the Pulp and Paper Industry at 2:00 p.m. on February 21. Some seven papers divided broadly into a survey of instruments and the use of instruments will be presented.

The evening meeting at 8 o'clock to be held at the auditorium of the Electrical and Gas Association of New York is in the nature of a popular session, featuring a Parade of Color. Admission to this session is by ticket only, but tickets may be procured without cost from the Secretary of the Council. It would facilitate matters if such requests were accompanied by a stamped, self-addressed envelope. Requests for tickets should be addressed to: Inter-Society Color Council, P. O. Box 155, Benjamin Franklin Station, Washington, D. C.

The sessions on February 22 will be devoted to discussions of important current problems, to be followed by luncheon groups at which the morning discussions will be continued. At 2:30 p.m. a Business Session will convene to hear the reports of the committees. Meetings on February 23 and 24 will be held jointly with the Optical and American Physical Societies at Columbia University. A Symposium on Optical Methods for the Study of Molecular Structure will be one of the features.

New Zealand Standards Index

Recently received from the New Zealand Standards Institute is the Index to New Zealand Standard Specifications, as of September 30, 1939. This Index lists the standards first in numeric sequence, then according to subject, abbreviated titles being used, and finally a list of standards broken down according to mechanical and general engineering, civil engineering, electrical, chemical, paints and coatings, building construction, plumbing, dairying, and methods of test.

Companies in the United States who are concerned with New Zealand standards can obtain a copy of this list by writing the New Zealand Standards Institute, Hamilton Chambers, 201 Lambton Quay, Wellington, C. 1. Since a few extra copies of the list were received, these will be sent to members as long as the supply lasts. Also, many of the New Zealand standards are on file at Headquarters and if any member is in urgent need of information about a New Zealand standard or wishes to borrow one for a short time, he may write A.S.T.M. Headquarters.

Methods of Designating Colors Published

There has recently become available in the form of a reprint from the Journal of Research of the National Bureau of Standards a report on "Methods of Designating Colors" by Deane B. Judd and Kenneth L. Kelly. This report covers Project No. 2 of the Inter-Society Color Council and is the basic one which resulted in the formation of the Color Council. As originally stated, the problem was "to find a means of designating colors in the U. S. Pharmacopoeia, the National Formulary, and pharmaceutical literature, such designation to be sufficiently standardized to be acceptable to science, sufficiently broad to be appreciated and usable by science, art, and industry, and sufficiently commonplace to be understood at least in a general way by the whole public."

Work has been under way on the problem for the past seven years and in June of this year the solution recommended by Messrs. Judd and Kelly was accepted by the Color Council. It is recommended for designating the colors of drugs and chemicals and is tentatively suggested for general use. The Council will appreciate any comments on the methods which should be forwarded to Doctor Judd at the National Bureau of Standards. Copies of the report can be obtained from the Superintendent of Documents, Government Printing Office, at 10 cents each.

Catalogs and Literature Received

Tinius Olsen Testing Machine Co., 500 N. Twelfth St., Philadelphia, Pa. Catalog No. 19 entitled "Static and Dynamic Balancing Machines." Presents briefly and concisely essential facts concerning this field and in a way that may readily be understood by anyone concerned with static and dynamic balancing. With a large number of clear illustrations, both photographs and charts, this 54-page publication is divided into 15 sections. Covers general principles and then discusses various types of machines giving information on their uses and significance, closing with useful charts, one showing the centrifugal force exerted by one ounce-inch at various speeds and a drill chart for use with balancing machines.

Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia, Pa. Catalog N-33B, 40 pages, entitled "Micromax and Speedomax Rayotube Pyrometers," pictures Rayotubes in a variety of applications. Diagrams show the various methods of applying these detectors, and actual-size color reproductions of chart-records illustrate the features of Micromax and Speedomax instruments which Rayotubes now make available to many new applications.

Also, Catalog E, entitled "Electrical Measuring Instruments for Research, Teaching, and Testing," 66 pages, listing the entire Leeds & Northrup line of instruments for research and for routine testing in laboratory, plant, and field.

Wilkens-Anderson Co., 111 N. Canal St., Chicago, Ill. A four-page folder describing a moderately priced glass electrode pH instrument, the Cameron One-Two pH Tester, portable and simple to use. Cameron Bulletin No. 42AS.

C. J. Tagliabue Manufacturing Co., Park and Nostrand Aves., Brooklyn, N. Y. Catalog No. 1100B, 16 pages, entitled "TAG Laboratory Thermometers and Hydrometers," includes complete listings of the widely used A.S.T.M. and General Purpose Thermometers with illustrations. The regular line of Extreme Precision and Standard Thermometers and Hydrometers is also described.

Humboldt Manufacturing Co., 2014 N. Whipple St., Chicago, Ill. A 32-page report by Prof. W. M. Dunagan of Iowa State College covering determination of specific gravities, free moisture, absorption, silt, and analysis of constituents of fresh concrete using the "buoyancy" principle. Illustrated with methods of computation and describes significance of tests. Third edition, 1939, available at price of $1.00.

NEW MEMBERS TO JANUARY 11, 1940

The following 56 members were elected from November 24, 1939 to January 11, 1940, making the total membership 4222:

Company Members (9)

Alhambra Foundry Co., Ltd., Paul Siechert, Metallurgist, 1147 Meridian Ave., Alhambra, Calif.

British Tube Mills (Australia) Proprietary, Ltd., Leslie Holmes, Works Manager, Lower North Road, Kilburn, Adelaide, South Australia.

General Ceramics Co., P. D. Helser, Executive Vice-President and General Manager, 30 Rockefeller Plaza, New York City.

Hospital Bureau of Standard and Supplies, Inc., D. H. Palmer, Research Engineer, 9 E. Fortieth St., New York City.

Karagheusian, Inc., A. & M., C. A. Karagheusian, Treasurer, 295 Fifth Ave., New York City.

Metals Disintegrating Co., Inc., J. D. Shaw, Chemical Engineer, Box 290, Elizabeth, N. J.

Nixon Nitration Works, S. R. Hartstein, Chief Chemist, Nixon, Middlesex County, N. J.

Republic Oil Refining Co., George Armistead, Jr., Assistant to Vice-President, 612 Second National Bank Building, Houston, Tex.

Springfield Boiler Co., Owsley Brown, President, Box 1000, Springfield, Ill.

Individual and Other Members (37)

Allen, C. W., Assistant Engineer, Ohio State Highway Testing Laboratory, Engineering Experiment Station, Ohio State University, Columbus, Ohio.

Argentina Ministerio de Marina, Dirección General de Administrativa, Division Laboratorios, Calle Estados Unidos y Azopardo, Buenos Aires, Argentina.

Colegio Provincial de Arquitectos Library, I. T. Cabrera, Librarian, Infanta y 25, Havana, Cuba.

Dahanukar, S. M., Kalbadevi, Bombay, India.

Daunheimer, H. P., President, Springfield Sand and Tile Co., Inc., 99 Cortland St., Springfield, Mass.

Dietz, Albert, Instructor, Massachusetts Institute of Technology, Room 5-304, Cambridge, Mass.

Dirección del Material Aeronautico del Ejército, Ia. Division, Biblioteca y Traducciones, Juncal 1116, Buenos Aires, Argentina.

Ellis, S. C., Vice-President, The Haller Engineering Associates, Inc., Cambridge, Mass. For mail: 87 Belleclaire Ave., Longmeadow, Mass.

Frederick, H. A., Assistant Materials Division Chief, Public Service Electric and Gas Co., 938 Clinton Ave., Irvington, N. J.

Gammeter, E. E., Contract Representative, Carnegie-Illinois Steel Corp., 208 S. La Salle St., Chicago, Ill.

Harvill, H. L., President, Harvill Aircraft Die Casting Corp., 2344 E. Thirty-eighth St., Los Angeles, Calif.

Hensel, F. R., Chief Metallurgical Engineer, P. R. Mallory and Co., Inc., 3029 E. Washington St., Indianapolis, Ind.

Irwin, R. R., General Manager, Socony-Vacuum Oil Co., Inc., 1400 Federal Reserve Bank Building, Kansas City, Mo.

Kathju, K. N., Consulting Chemist, Arco Co., Cleveland, Ohio. For mail: 2-126 General Motors Building, Detroit, Mich.

Lake, G. K., Pepperell Manufacturing Co., 40 Worth St., New York City.

Lamb, M. R., Engineer, New York Steel Exchange, Argentina, B Irigoyen 330, Buenos Aires, Argentina.

Long, L. M., Metallurgist, Bunting Brass and Bronze Co., 715 Spencer Ave., Toledo, Ohio.

Lowry, C. D., Jr., Chemist, Service Dept., Universal Oil Products Co., 310 S. Michigan Ave., Chicago, Ill.

Marden, E. R., Manager, Cement and Concrete Dept., Rush Engineering Co., 629 W. Washington Boulevard, Chicago, Ill.

Massachusetts Institute of Technology Library, Cambridge, Mass.

Meissner, H. S., Engineer, U. S. Bureau of Reclamation, 1080 S. Gilpin St., Denver, Colo.

Merrill, K. V., Electrical Sheet Metallurgist, Niles Rolling Mill Co., Niles, Ohio.

Mutter, F. E., Manager, New York Office, Pittsburgh Testing Laboratory, 157 Chambers St., New York City.

Redfern, G. E., Metallurgist, Godfrey Manufacturing Corp., Sanford St. and Jersey Ave., New Brunswick, N. J.

Ripper, K. E., Consulting Chemist, American Cyanamid Corp., New York City. For mail: 11 Overhill Road, Bronxville, N. Y.

Ryan, J. D., Assistant Director of Research, Libbey-Owens-Ford Glass Co., Toledo, Ohio. For mail: 3906 Elmhurst Road, Toledo, Ohio.

Schmitt, L. P., Sales Engineer, The Joslyn Co., 70 Pine St., New York City.

Sherman, O. R., Manager, Houston Office, Pittsburgh Testing Laboratory, 317 Merchants and Manufacturers Building, Houston, Tex.

Simonds, Herbert R., Consulting Engineer, 20 Christopher St., New York City.

Thayer, H. H., Naval Architect and Marine Engineer, Witherspoon Building, Philadelphia, Pa.

Tufts College Library, Librarian, Medford, Mass.

Wales, E. L., Engineer of Materials and Tests, Arkansas Highway Commission, Little Rock, Ark.

Walworth, C. A., Chief Chemist, Libbey-Owens-Ford Glass Co., Charleston, W. Va.

Watkins, G. B., Director of Research, Libbey-Owens-Ford Glass Co., Toledo, Ohio. For mail: 3004 Berdan Ave., Toledo, Ohio.

Watt, A. G., Manager, Service Bureau, Lehigh Portland Cement Co., Young Building, Allentown, Pa.

Webb, A. A., Superintendent-Engineer, Riverside Water Co., 6718 Magnolia Ave., Riverside, Calif.

Young, G. M., Chief Metallurgist, Aluminum Co. of Canada, Ltd., 158 Sterling Road, Toronto, Ont., Canada

Junior Members (10)

Armstrong, R. S., Chemist (Treater), Solar Refinery, The Standard Oil Co. (Ohio), Lima, Ohio. For mail: 338 W. First St., Delphos, Ohio.

Cafiero, Dominick, 2 Lorraine Ave., Mt. Vernon, N. Y.

Francis, D. A., Engineering Dept., Pressed Steel Tank Co., West Allis, Wis. For mail: 1101 S. Fifty-sixth St., Milwaukee, Wis.

Hamrick, J. J., Jr., Physical Laboratory Assistant, The Chesapeake & Ohio Railway Co., Huntington, W. Va. For mail: 1801 Third Ave., Apartment 1, Huntington, W. Va.

Perla h., Antonio, Instructor and Professor, Universidad Nacional, Facultad de Ingenieria, San Salvador, El Salvador. For mail: 2a Calle Poniente No. 124, San Salvador, El Salvador.

Riemenschneider, W. K., Research Engineer, The Union Metal Manufacturing Co., Canton, Ohio. For mail: 1133 Colonial Boulevard, N. E., Canton, Ohio.

Schlueter, W. E., Sales Engineer, Refinery Supply Co., 1309 Capitol Ave., Houston, Tex.

Staple, Ezra, Chemist, Standard Chemical Co., Philadelphia, Pa. For mail: 5600 Wyndale Ave., Philadelphia, Pa.

Tinnes, E. Lorain, Student Engineer, General Electric Co., Pittsfield, Mass. For mail: 275 Springside Ave., Pittsfield, Mass.

Wileman, E. E., Process Engineer, Lockheed Aircraft Corp. Burbank, Calif.

"Now I Tin Whistle"

"I bought a wooden whistle, but it wooden whistle.
I bought a lead whistle, but they wooden lead me whistle.
I bought a copper whistle, but the copper wooden lead me whistle.
I bought a steel whistle, but steel the copper wooden lead me whistle.
I bought a zinc whistle, but while I zinc it wood whistle
Steel the copper wooden lead me whistle.
So I bought a tin whistle, and now I tin whistle."

Link-Belt News

PERSONALS

• • • News items concerning the activities of our members will be welcomed for inclusion in this column.

T. A. Boyd, Head, Fuel Department, Research Laboratories Division, General Motors Corp., Detroit, Mich., was the recipient of the 1939 Lamme Medal awarded annually by Ohio State University to one of its graduates for "meritorious achievement in engineering."

R. P. Anderson, Secretary, Division of Refining, American Petroleum Institute, New York City, was elected chairman of the Standards Council of the American Standards Association, at its annual meeting held recently in New York City.

J. G. Goonley, formerly Sales Engineer, Walworth Co., is now Production Engineer, The Lucas Machine Tool Co., Cleveland, Ohio.

P. V. Brown is Assistant Subway Engineer, City of Chicago, Department of Subways and Traction, Chicago, Ill. He was formerly Manager, Rush Engineering Co., Chicago, Ill.

D. L. Colwell, who was associated with Stewart Die Casting Division, Stewart-Warner Corp., Chicago, is now Metallurgical Engineer, Paragon Die Casting Co., Chicago, Ill.

E. C. Lathrop, formerly Vice-President, Celotex Corp., Chicago, Ill., is now Chief, Agricultural Wastes Division, Northern Regional Research Laboratory, U. S. Department of Agriculture, Peoria, Ill.

The following A.S.T.M. members were included in the group nominated for office of the American Concrete Institute, as reported by the 1939 Nominating Committee of the Institute:

President, R. B. Young, Testing Engineer, Hydro-Electric Power Commission of Ontario, Toronto, Canada; *Vice-President*, R. E. Davis, Professor of Civil Engineering, In Charge of Engineering Materials Laboratory, University of California, Berkeley, Calif.; *Director, Fourth District*, Roy W. Crum, Director, Highway Research Board, National Research Council, Washington, D. C.; *Director, Sixth District*, H. F. Thomson, Vice-President, General Material Co., St. Louis, Mo.; and *Director-at-Large*, F. E. Schmitt, *Engineering News Record*, New York City.

Herbert Spigel, formerly Architect, connected with George Howe, Philadelphia, Pa., is now Industrial Engineer and Architect, Atlanta, Ga.

Charles Wirth, III, is now in the Organic Chemicals Dept., E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. He was in the Service Department, Universal Oil Products Co., Chicago, Ill.

J. J. Moran, who was Chemical Engineer, Kimble Glass Co., Vineland, N. J., has been appointed to the position of Technical Manager of the Sales Department.

S. F. Cox has recently been made Technical Director of the Double Glazing Division, Pittsburgh Plate Glass Co., Pittsburgh, Pa. He was formerly Director of Technical Sales, Pittsburgh Corning Corp.

NECROLOGY

We announce with regret the death of the following members and representative:

A. Berlhe DeBerlhe, Inspector General, Bureau Veritas, Paris, France. Member since 1921.

Edward N. Hurlburt, Sales Engineer, Taylor Instrument Companies, Rochester, N. Y. Member since 1922. Mr. Hurlburt was a member of Committee D-2 on Petroleum Products and Lubricants, Subcommittees II and XII; also a Special Adviser-Member on Subcommittee XII on Laboratory Apparatus of Committee E-1 on Methods of Testing.

P. G. Lang, Jr., Engineer of Bridges, Engineering Dept., The Baltimore & Ohio Railroad Co., Baltimore, Md. Mr. Lang had recently renewed his membership having been a member for many years beginning in 1921.

I. B. McCorkle, Director, Research Laboratory, Department of Metallurgy and Research, National Tube Co., Pittsburgh, Pa. Member since 1928.

George F. Schlesinger, Chief Engineer and Managing Director, National Paving Brick Assn., Washington, D. C. At the time of his death Mr. Schlesinger was representing the association on Committee C-15 on Manufactured Masonry Units, Subcommittees V on Paving Brick and VI on Sewer Brick; also on Committee D-4 on Road and Paving Materials, Subcommittee C-5 on Portland-Cement Concrete for Pavements and Bases; was Chairman of Subcommittee C-6 on Brick and Block Pavements; D-3 on Expansion Joint Materials, and was a member of the A.S.A. Sectional Committee on Methods of Testing Road and Paving Materials.

Clarence W. Spicer, Vice-President, Spicer Manufacturing Corp., Toledo, Ohio. Member since 1925.

Eugene C. Willman, Chemist, Cleveland Electric Illuminating Co., Cleveland, Ohio. Member since 1919.

Calendar of Society Meetings

(Arranged in Chronological Order)

American Institute of Electrical Engineers—Annual Winter Convention, January 22–26, New York City.

American Society of Heating and Ventilating Engineers—Sixth International Exposition, Lakeside Hall, January 22–26, Cleveland, Ohio.

American Road Builders' Association—37th Annual Convention and Road Show, January 29–February 2, Chicago, Ill.

American Institute of Mining and Metallurgical Engineers—Annual Meeting, February 12–15, New York City.

American Concrete Institute—36th Annual Convention, Palmer House, February 27–29, Chicago, Ill.

American Society for Testing Materials—Committee Week and Spring Meeting, March 4–8, Detroit, Mich.; Annual Meeting, June 24–28, Atlantic City, N. J.

American Chemical Society—April 8–13, Cincinnati, Ohio.

American Society of Mechanical Engineers—Spring Meeting, May 1–3, Worcester, Mass.; Semi-Annual Meeting—June 17–21, Milwaukee, Wis.

American Foundrymen's Association—Forty-fourth Annual Convention and Exhibition, May 6–10, Palmer House, Chicago, Ill.

American Institute of Chemical Engineers—Thirty-second Annual Convention, May 13–15, Statler Hotel, Washington, D. C.

Society of Automotive Engineers—Summer Meeting, June 9–14, The Greenbrier, White Sulphur Springs, W. Va.

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